AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT

AUGUST 15, 1956

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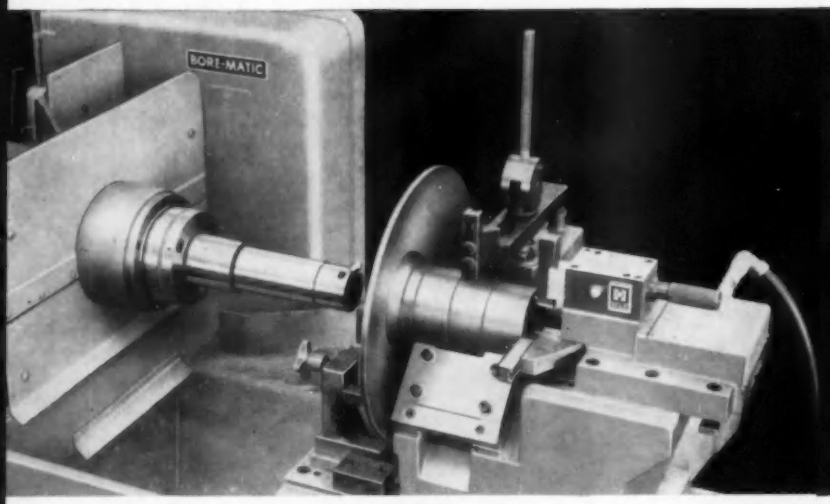
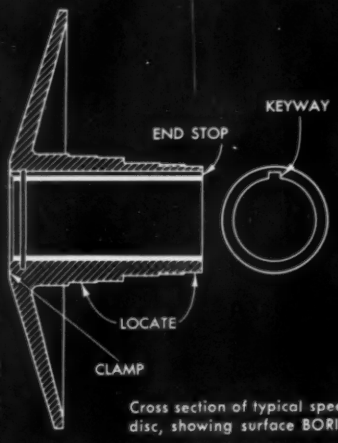
A CHILTON PUBLICATION

The extreme versatility of Heald **BORIZING*** permits faster precision finishing of both long-run jobs and small-lot work with frequent changeovers

FOR EXAMPLE: *This One Bore-Matic Finishes 41 Different Parts, with a production increase of over 200%!*





Cross section of typical speed changer disc, showing surface BORIZED.

The Model 221 Bore-Matic shown above is equipped with interchangeable tooling and adjustable fixture for precision boring 41 different speed changer discs, with bore diameters ranging from 0.688" to 3.2510" and bore lengths from 2⅜" to 9⅜". Compared to the previous method of doing the same job, BORIZING increased total net production from 4 parts to 13 parts per hour.

It PAYS to come to Heald

**BORIZING is a copyrighted word meaning the application of any number or variety of precision finishing operations performed on a Heald Bore-Matic.*

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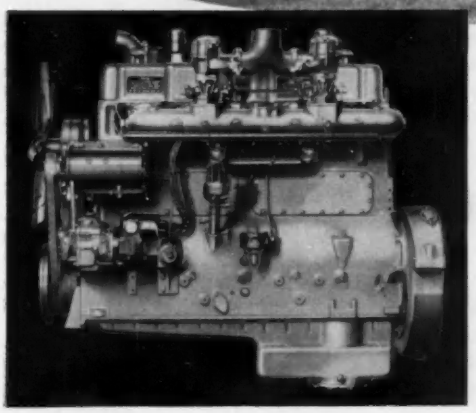

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Typical 145 Series 779 or 817 cu. in., up to 275 hp.

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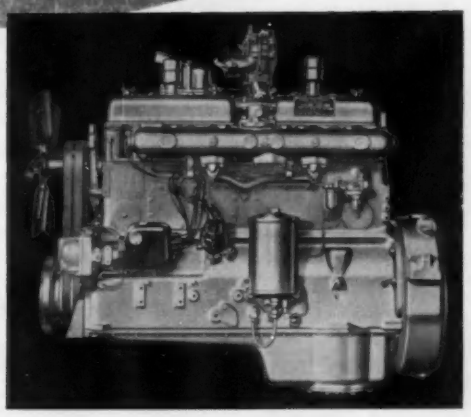


Inconel makes "pipe dreams" come true

— *in the strangest places!*

Where are we? Looking up at the underbelly of a huge gasoline-powered tractor truck, just in from a long-haul run.

You'll be interested in that exhaust pipe overhead. But don't touch it! *It's red hot.*

Truck operators find most pipes a big source of trouble. When one "blows" on the highway, it means a delayed delivery . . . lost time for the driver...extra expense to the company.

Saving dollars. An ordinary exhaust pipe seldom lasts over 40,000 miles, and usually has to be replaced several times a year. Think what might be saved if a pipe *never* had to be replaced!

A pipe dream? Now it's a reality, thanks to the resourcefulness of a smart maintenance superintendent. Years ago, he started replacing worn-out carbon steel exhaust pipes with new ones made of Inconel®.

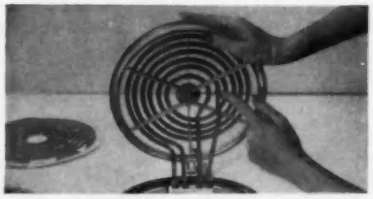
Crowding the million mark. Not a single Inconel pipe has ever been replaced. *Several have already logged almost a million miles each.*

Right now, you may have a metal problem of your own. It doesn't have to resemble this one. Inconel — possibly — is not *your* answer. But remember, there are more than 50 *other* Inco Nickel Alloys available. Find out whether one of them offers the means of transforming a cherished "pipe dream" of *yours* into a reality! Let's talk it over sometime soon.

Q. Where else is Inconel an outstanding success?

A. In jet planes — specifically in *flame tubes*. Here Inconel stubbornly maintains its strength even when white hot.

Q. Where would you be likely to see Inconel?



A. In a kitchen. Inconel sheathing is used on the surface heating units of most electric ranges. Inconel provides quick, even transmission of heat. It resists corrosion. It stands up under use — and abuse.

Q. Where can you find more information on Inconel and half a hundred *other* problem-solving Inco Nickel Alloys?

A. Write for our booklet, *Standard Alloys for Special Problems*. It's free to all who ask for it.

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AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE — PUBLISHED SEMI-MONTHLY

AUGUST 15, 1956 — VOL. 115, NO. 4

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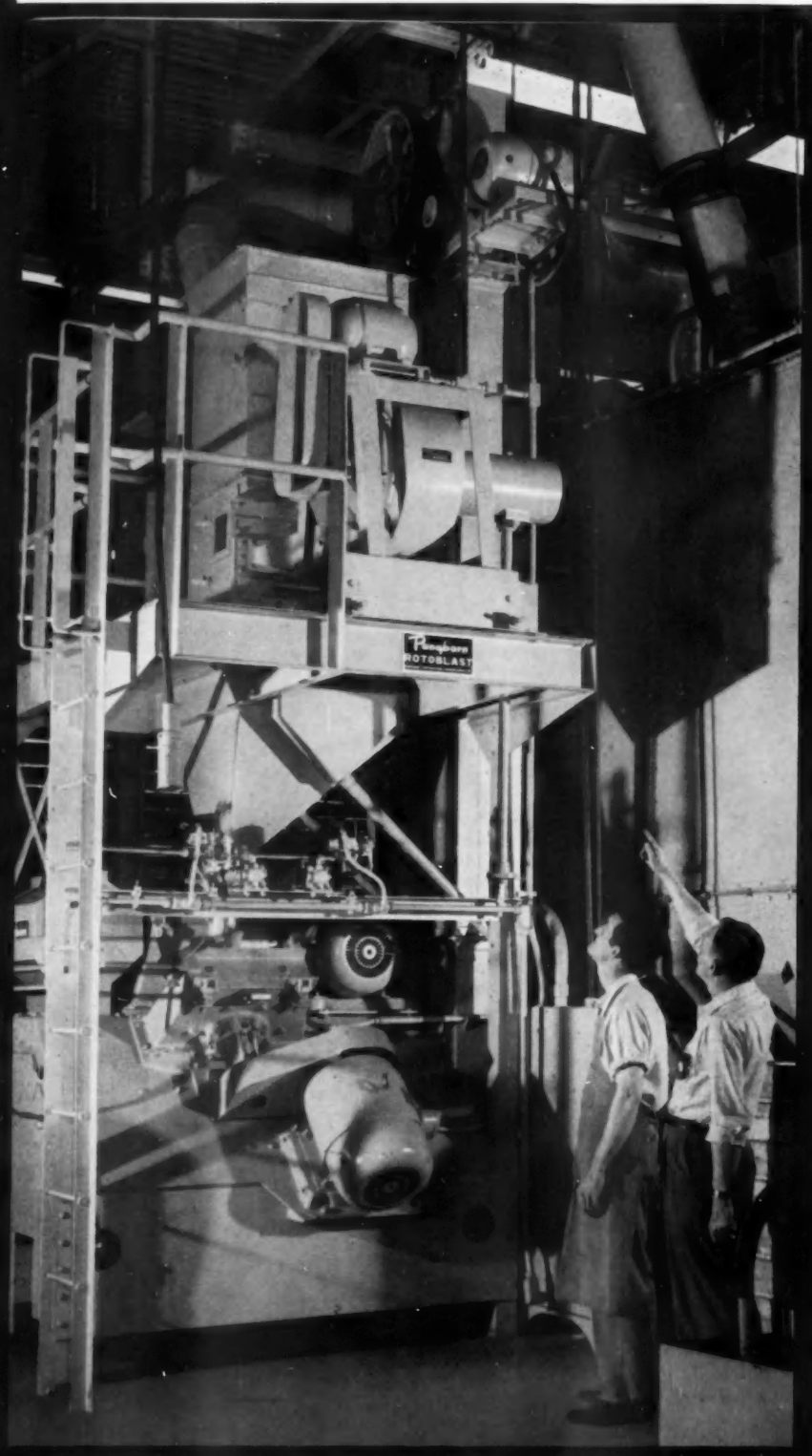

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The special Pangborn Rotoblast Blast Cleaning Machine at left was designed by Pangborn for Hamilton Standard Division of United Aircraft Corp. This installation is used for blast cleaning and shot peening . . . saving Hamilton $20,000 a year. Below is another special Pangborn machine, owned by Parish Pressed Steel Division of Dana Corp., Reading, Pa. This Rotoblast Descaling Machine is used to clean steel sheets and coiled strip ranging in widths from 19″ to 60″ at a line speed of from 80′ to 150′ per minute.

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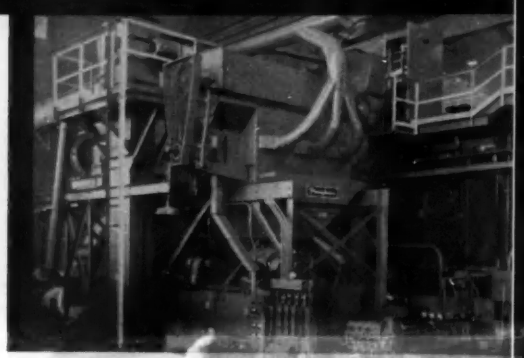

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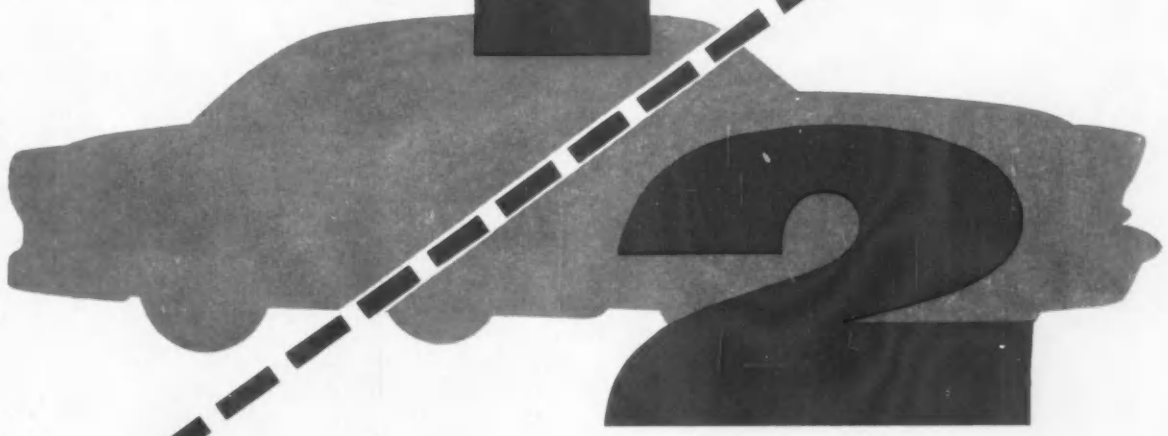

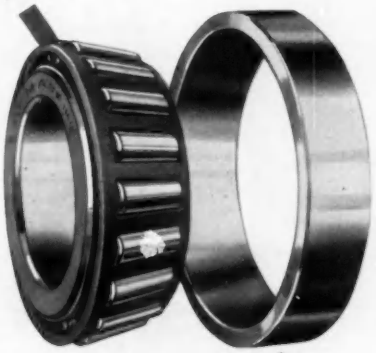

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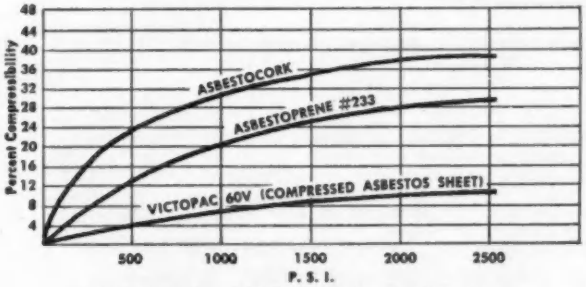

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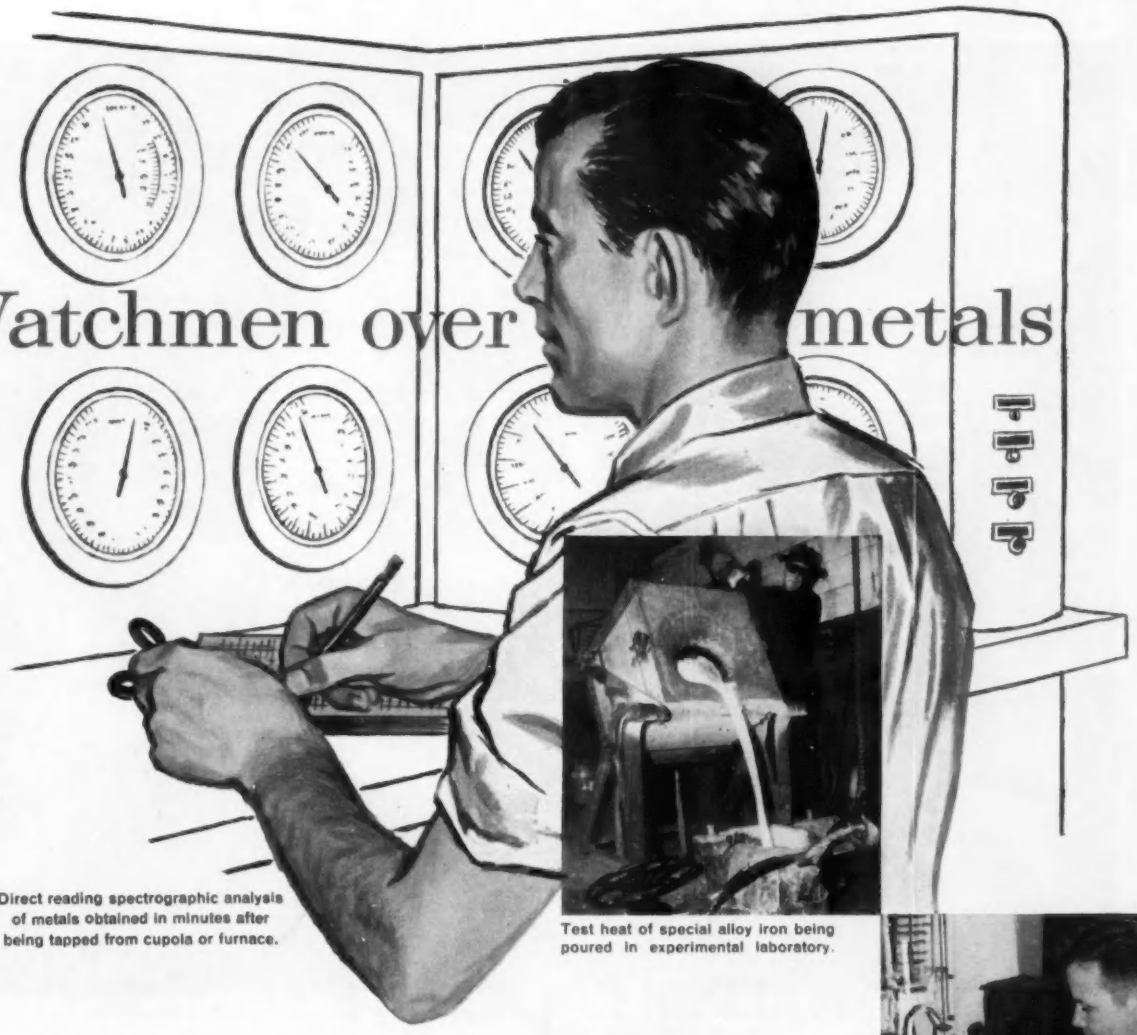

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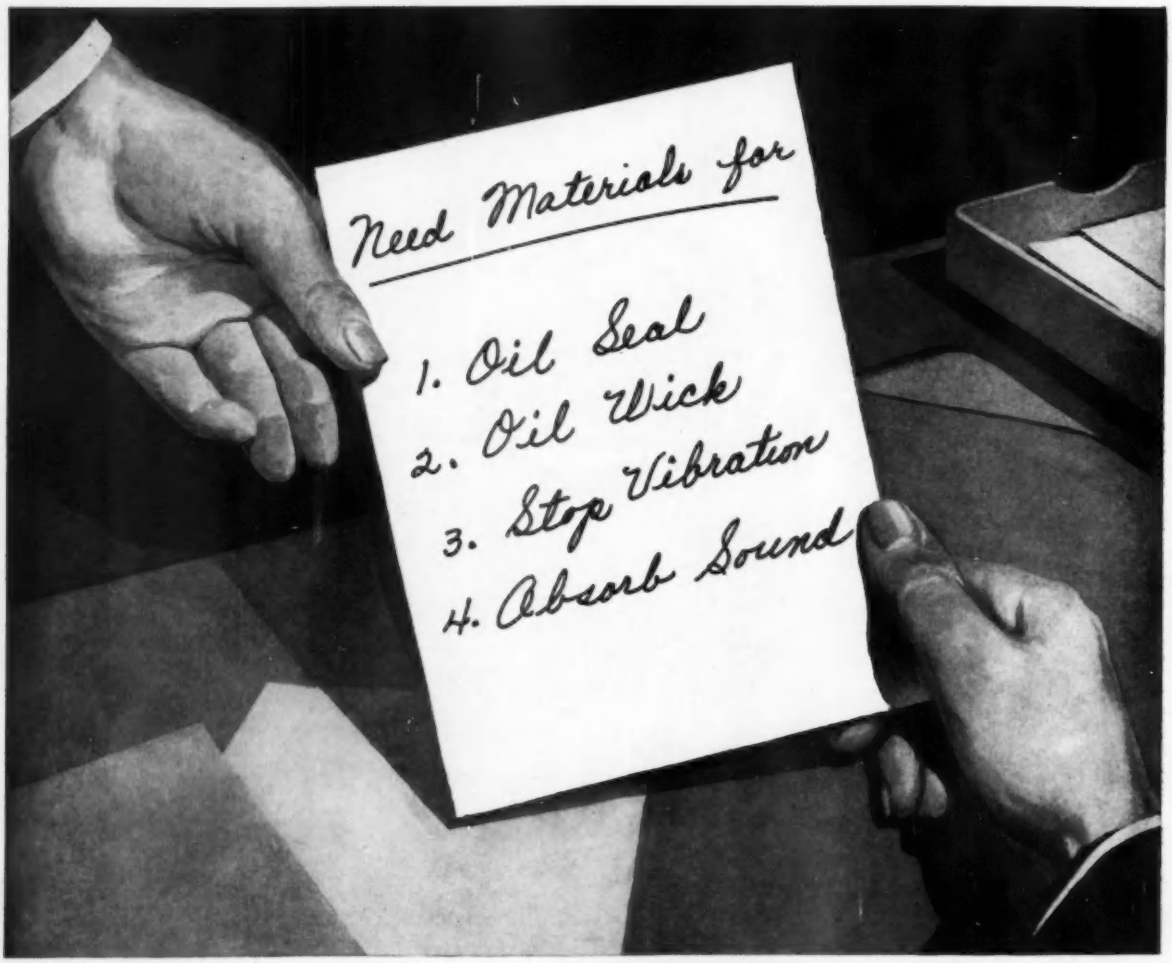

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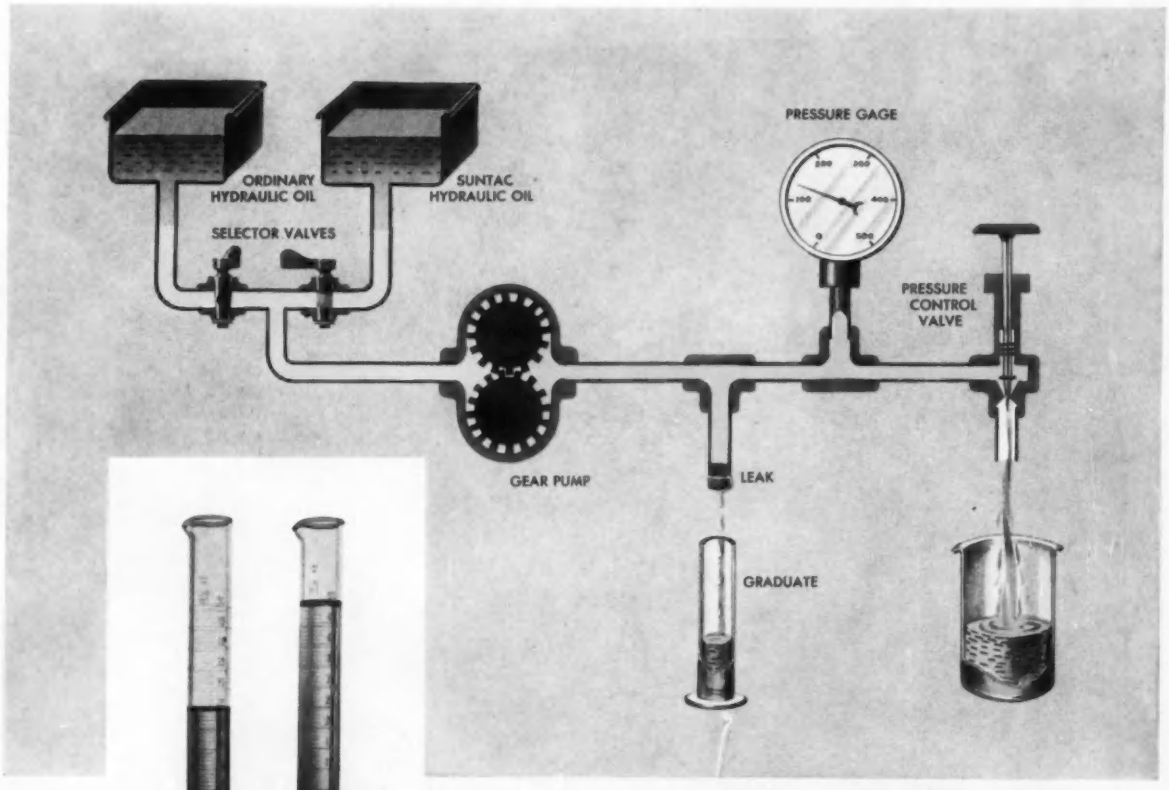

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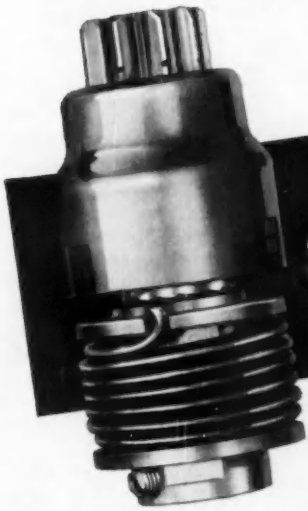
Export Sales: Bendix International Division, 205 East 42nd Street, New York 17, N. Y.

Bendix folo-thru starter drive



costs less—*Like the millions of Bendix Starter Drives manufactured for the industry, the new Folo-Thru Drive requires no actuating linkage, and the less expensive solenoid may be placed in any convenient position. Result is lower installation and maintenance costs. Complete detailed information is available on request.*

*REG. U.S. PAT. OFF.

Bendix* Folo-Thru Starter Drive Bendix* Automotive Electric Fuel Pump Stromberg* Aeroquad Carbureter

Aluminum reduces cost for AMC

Essex Wire Corporation Battery Cable—
Made of Kaiser Aluminum—
provides saving of 14%

American Motor Corporation engineers, alert for ways to reduce costs without reducing quality and performance, have standardized on aluminum battery cable for Rambler, Nash and Hudson cars.

Aluminum cable, supplied by Essex Wire Corporation, Detroit, weighs only half as much as copper and *provided an initial cost reduction of over 14%.* Aluminum's light weight also makes possible additional savings in shipping costs and contributes to over-all weight reduction.

This all new aluminum battery cable was engineered,

and designed to supply equal current carrying capacity and lower resistance than equivalent copper cable.

This is one more example of how versatile aluminum . . . combined with sound engineering . . . can improve quality and reduce costs in the automotive industry.

Make our automotive development engineers your *"idea partners."* Combine your knowledge of your product with our experience with aluminum to help you obtain maximum improvements and savings.

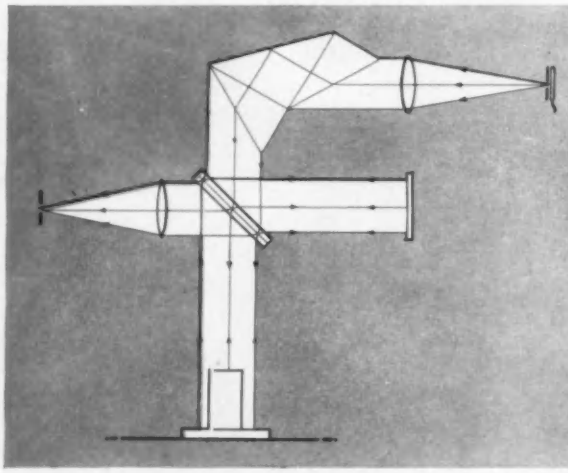
Also, if you need assistance in finishing, welding, forging, roll-forming, extrusions, stampings, castings—or desire engineering service or fabricating counsel—our development engineers will gladly provide it.

Call our *Automotive Development Division,* TRinity 3-8000, Kaiser Aluminum & Chemical Sales, Inc., 1414 Fisher Bldg., Detroit 2, Michigan. *General Sales Office,* Palmolive Bldg., Chicago 11, Ill.; *Executive Office,* Kaiser Bldg., Oakland 12, California.

Kaiser Aluminum

See "THE KAISER ALUMINUM HOUR." Alternate Tuesdays, NBC Network. Consult your local TV listing.

A NEW DIMENSIONAL AUDITING SERVICE FOR INDUSTRY



A Standards Laboratory—America's first commercial dimensional Standards Laboratory has just been dedicated in Dayton by The Sheffield Corporation.

The Eli Whitney Metrology* Laboratory was designed, constructed and equipped in accordance with the experience and standard practices of the great national laboratories of the United States, Great Britain, France and Germany. Thus, this new "Bureau of Standards" is qualified to supplement the work of the governmental laboratories in calibrating and certifying dimensional standards for industry.

Here, also, dimensional audits of precision mechanical components are made—audits not practicable except with the equipment and under the unmatched accurately controlled environment of this Standards Laboratory.

Here, overall dimensional control programs are developed for individual manufacturers—gage surveillance operations worked out in detail.

Here, key personnel responsible for dimensional control can study the philosophy of high precision—can get the feel of high precision equipment and become familiar with the procedures involved.

As to the Laboratory's name—what could be more fitting than to honor that illustrious pioneer, Eli Whitney?

It was Eli Whitney who taught the world the practical value of consistent dimensional precision as the essential of interchangeable parts manufacture.

It was Eli Whitney who thereby introduced our modern era of mass production and economic abundance.

It was Eli Whitney's achievements which demonstrated the blood relationship between dimensional precision and product quality.

The Eli Whitney Metrology Laboratory now takes its place as industry's ally in carrying on this tradition.

For a more comprehensive account of the facilities and capabilities of this unique Laboratory, write for Bulletin ML 1-56. Dept. 4.

Metrology—The science of measurement.

MASTER CRAFTSMAN GOLDEN ANNIVERSARY HEADQUARTERS

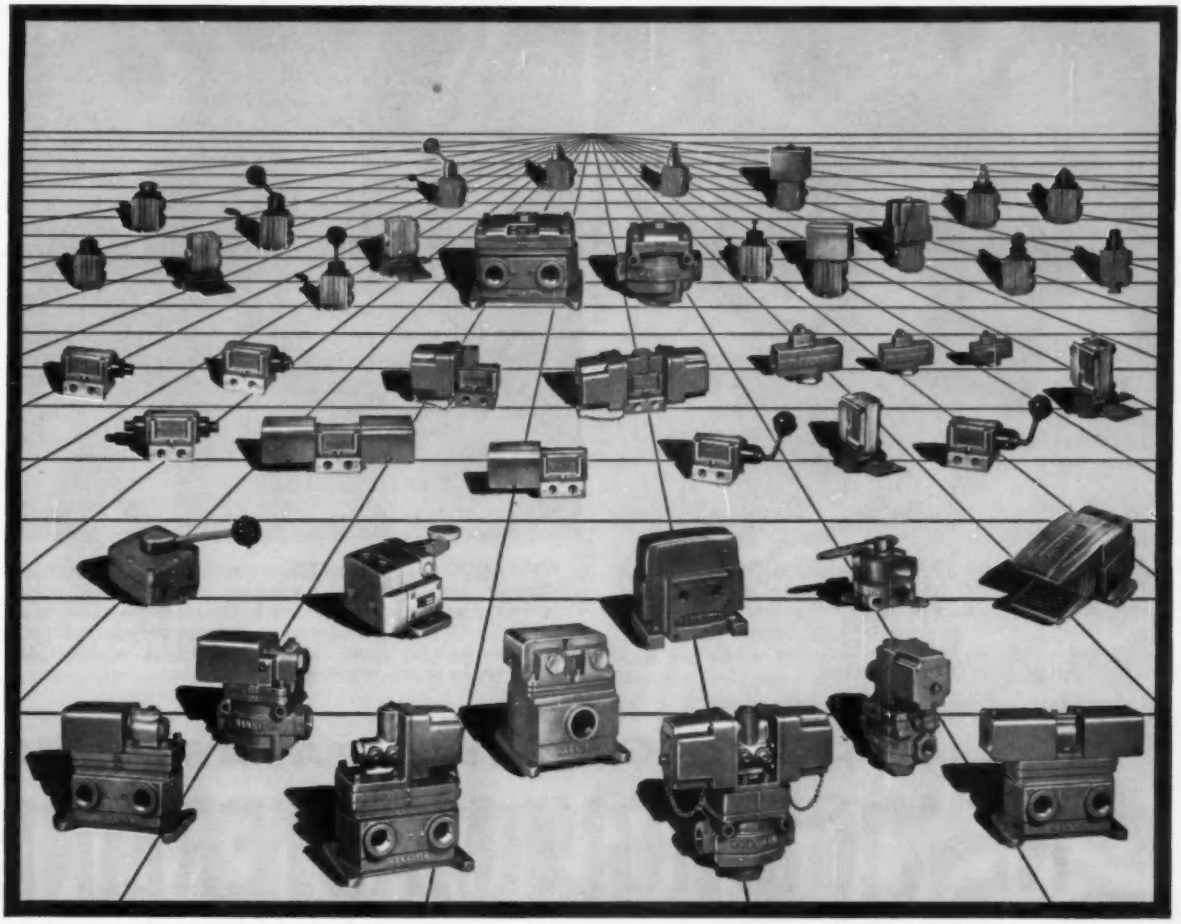
SHEFFIELD

Manufacture and Measurement for Mankind

7440

THE SHEFFIELD CORPORATION • DAYTON 1, OHIO, U.S.A.

FOR AIR CYLINDER CONTROL... Manual or Electric



Hannifin is your best valve source

What air control valves do you need, or prefer? Hannifin has all types—for your production lines or the machines you manufacture. They include:

P-M Pilot-Master Valves, solenoid controlled by integral pilot heads (including new-type, dust-tight, splashproof heads that completely meet J.I.C. recommendations). ⅜" to 1¼". 2-way, 3-way and 4-way.

P-M Master Valves. ¾" to 1¼". 2-way, 3-way and 4-way, air operated. For remote control from a wide choice of P-M Pilot Valves.

P-M Direct-Operated Valves. For direct control of small air cylinders. 2-way, 3-way and 4-way. ¼" and ⅜".

Disc Valves. Rotary and sliding reciprocating disc types for hand, foot or electric operation. ⅛" to ¾".

Micrometric Speed Control Valves for micrometer-like speed adjustment through control of exhaust flow.

You can simplify your air control problems by standardizing on Hannifin.

Stock Delivery On All Types

HANNIFIN

MAIL THE COUPON FOR PROMPT ACTION

- ☐ Have Field Engineer call at once
- ☐ Have Field Engineer stop by soon
- ☐ For the present, just send complete Hannifin Control Valves Catalog

Hannifin Corporation, 543 S. Wolf. Rd., Des Plaines, Illinois

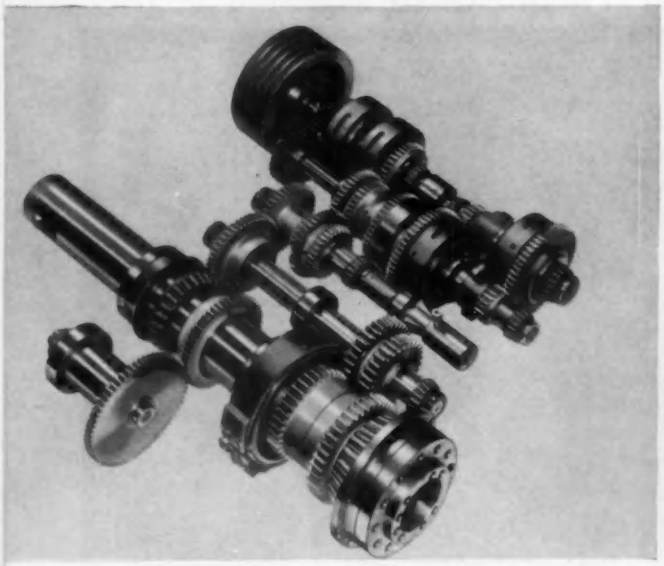
Name.....*Title*.....

Company.....

Address.....

City.....*Zone*.....*State*.....

WANT MORE POWER, MORE SPEEDS?



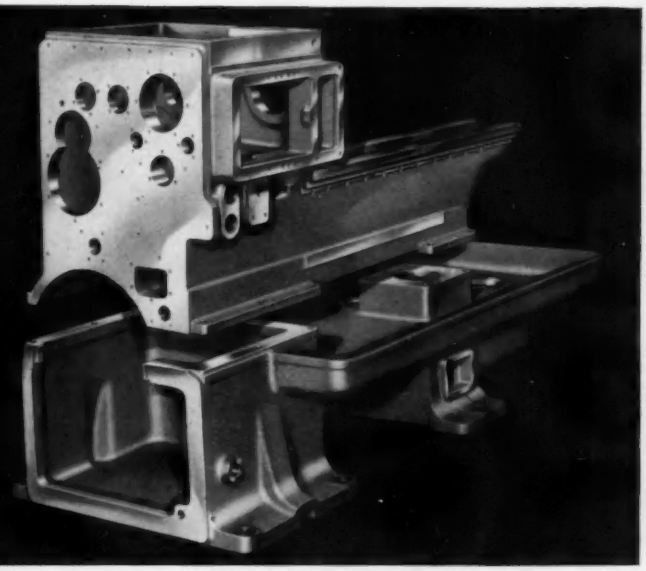
NEW HEADSTOCK GEAR TRAIN—sixteen different spindle speeds available, powered by up to 30 h.p. single-speed driving motor delivering full power at all speeds. Spindle is mounted on selected pre-loaded, precision-tapered roller bearings. Heavier, more rugged design provides smoother, quieter power.

HYDRAULIC SPEED SELECTOR—smooth, effortless speed changes. No waiting, no computing, no stopping of spindle, no releasing of main drive clutch. Operates direct or pre-set. Hi-Lo Lever permits instantaneous speed changes in 8:1 ratio without moving Speed Selector handwheel. Multiple Disc Clutches have automatic take-up for wear.

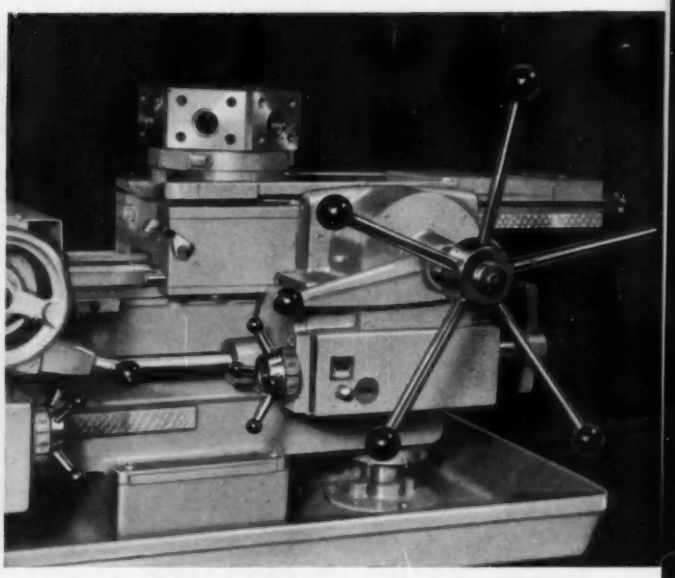
YOU GET THEM ALL...PLUS

NEW GISHOLT MASTERLINE

WANT HEAVY CUTS WITHOUT VIBRATION?



NEW HEADSTOCK AND BED CASTING—scientific design dampens out vibrations, assures smooth operation and simplifies holding closer tolerances. Made from semi-steel, poured in Gisholt's own foundry. Greater swing over ways permits bigger chucks and broader range of workpiece sizes. Provides a solid foundation for all types of work.



NEW TURRET RAM AND SADDLE—designed wider, heavier, more rigid to handle increased capacity and higher speeds. Dial-type feed selector makes feed changes faster, easier. Turret ram rigidly supported on 64-66 Rockwell C alloy steel way strips. Power transmitted through serrated tooth clutches, with shear pin protection against overloading.

GREATER VERSATILITY...WITH THE

RAM TYPE TURRET LATHE

YOU'LL SPEED UP your production jobs—both large and small—with this more powerful, more versatile Gisholt MASTERLINE Ram Type Turret Lathe.

Here is a machine designed from end-to-end for easier setups, faster change-over and higher productive output than ever before. Check the advanced features illustrated above. Note the reserve power to handle your heaviest cuts—and to meet your tooling requirements of tomorrow. Note the extra spindle speeds—all at your operator's finger tips, without computing—for faster, better turning of any type material. And look over the new massive design, the over-all ruggedness that permits greater accuracy, closer tolerances, deeper cuts at punishing feeds without vibration.

Find out now how this powerful, flexible Gisholt MASTERLINE Ram Type Turret Lathe can reduce floor-to-floor time on your specific jobs. Call your Gisholt Representative today—let him show you how this advanced machine can fit most profitably into your production picture. Or write direct to Gisholt for the new literature described below.

READY NOW—all-new, 18-page illustrated Bulletin No. 1174-B, covering features, accessories, tools and floor plans on new Gisholt MASTERLINE Ram Type Turret Lathes. Ask for it!

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

don't lose a day...

THE *HOTTEST* O.B.I.

without the spectacular facts

TOTALLY ENCLOSED . . .
BRAND NEW FROM THE GROUND UP

- Rugged, front-to-back crankshaft with huge crankpin
- Fully concealed, yet accessible, driving mechanism
- Enclosed, rigidly supported gearing operates in sealed oil bath
- Electro-pneumatic friction clutch on crankshaft
- Wider spaced, longer, narrower gibs
- Wider, box type slide all within gibbing
- Precision, hardened, longer-wearing gears
- Compact, straight-line, space-saving, all-steel frame

This is it! The most talked about press in the world! The press that captured the hearts of the entire industry at the Machine Tool Show! The press that was born to do more than any O.B.I. ever built!

Get the spectacular facts and figures on this metalworking marvel . . . the all-new Niagara Series E, Front-to-Back Crankshaft Inclinable. It outmodes everything within its range (75 to 200-ton capacities, 4 ½ to 7 ½ inch shaft diameters, standard and automated models).

PRESS IN HISTORY!

STUDDED WITH SCORES OF
TECHNICAL IMPROVEMENTS

- No overhanging gears, flywheel and other mechanisms
- No damaging crankshaft deflection
- Full support to wide dies — no overhang on slide
- Greater resistance to off-center loading
- Accurate alignment of slide, with minimized tendency to cock
- Substantially increased die life
- Smoother, safer press performance — simpler, thriftier servicing
- Less floorspace required

just send this...

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

Please rush new Bulletin 56 with all the facts on your brand new Series E Inclinable.

Name _____ Title _____

Company _____

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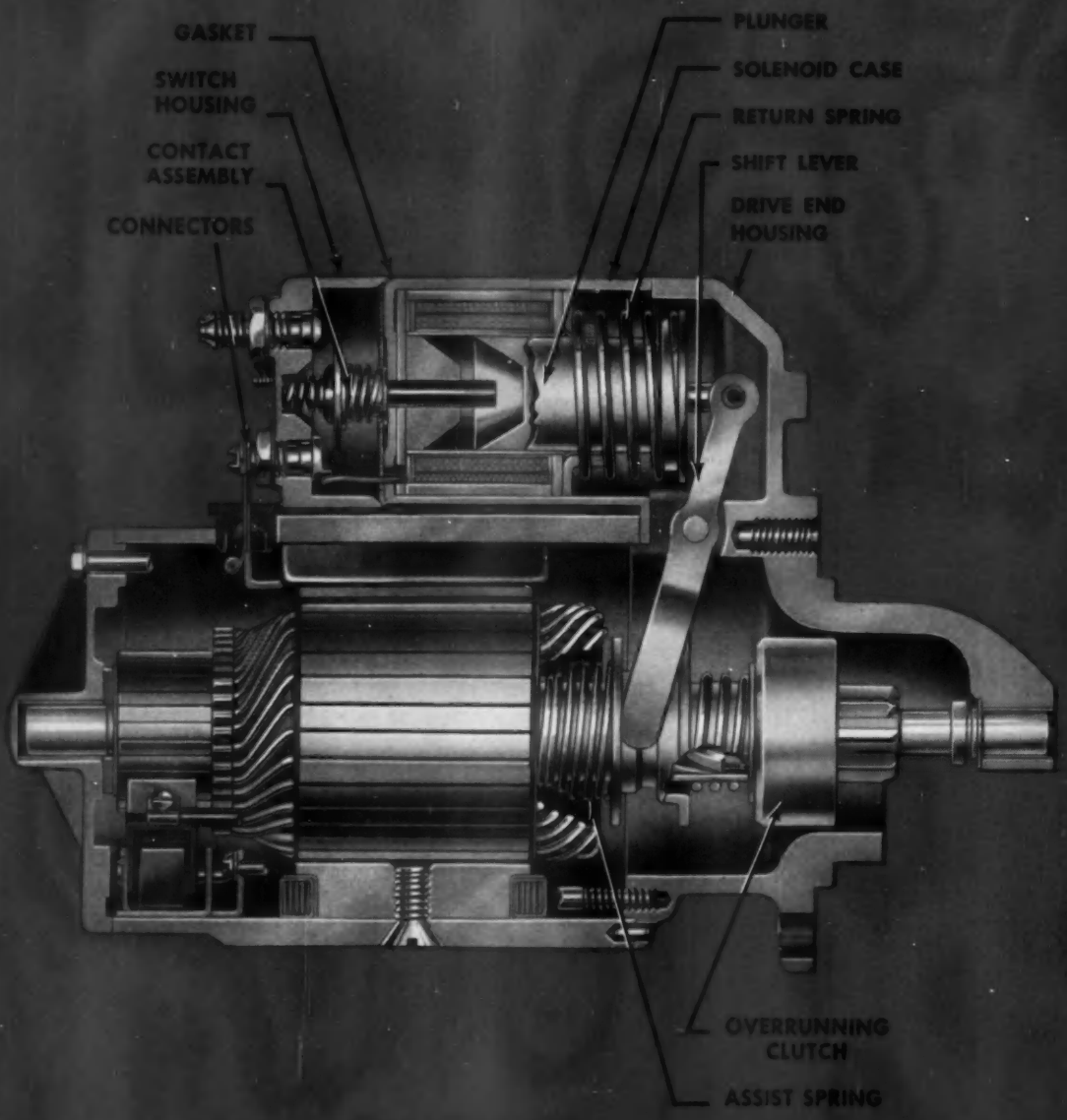
26 FACT-FILLED PAGES

NIAGARA

front-to-back crankshaft
INCLINABLE PRESSES

America's Most Complete Line of Presses, Shears, Press Brakes, Other Machines and Tools for Plate and Sheet Metal Work.

PROGRESSIVE ENGINEERING MAKES THE DIFFERENCE



DELCO-REMY PRESENTS A NEW TREND-SETTING ENCLOSED SHIFT LEVER CRANKING MOTOR

Delco-Remy's newly developed Enclosed Shift Lever cranking motor provides effective shielding from road splash, ice and dirt—assures greater starting dependability in all weather—requires no periodic lubrication.

The unique drive end housing completely encloses the entire shift mechanism, including solenoid plunger, lever, lever shaft, and overrunning clutch drive. Specially designed, the new built-in solenoid has a seamless drawn steel case, an improved gasket between case and switch housing, a longer bearing surface for the plunger, and an improved contact assembly with molded insulator actuating rod. The solenoid case is flange mounted tightly to the protective drive end housing, and the switch is electrically connected directly to the motor by extensions of the field coils which pass through an elastic grommet in the frame.

A special compressed assist spring on the armature shaft aids the solenoid during initial movement to provide more positive shift action on engagement. A strong, smooth-acting, compression-type shift lever return spring—located inside the solenoid case—assures quick, unhesitating disengagement from the flywheel.

The new, more compact, smaller diameter overrunning clutch saves vital mounting space—reduces interference problems—makes possible a shorter overall motor length.

This revolutionary new cranking motor—introduced on General Motors cars for '56—is another example of Delco-Remy leadership "Wherever Wheels Turn or Propellers Spin."

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

GM GENERAL MOTORS

GENERAL MOTORS LEADS THE WAY—STARTING WITH

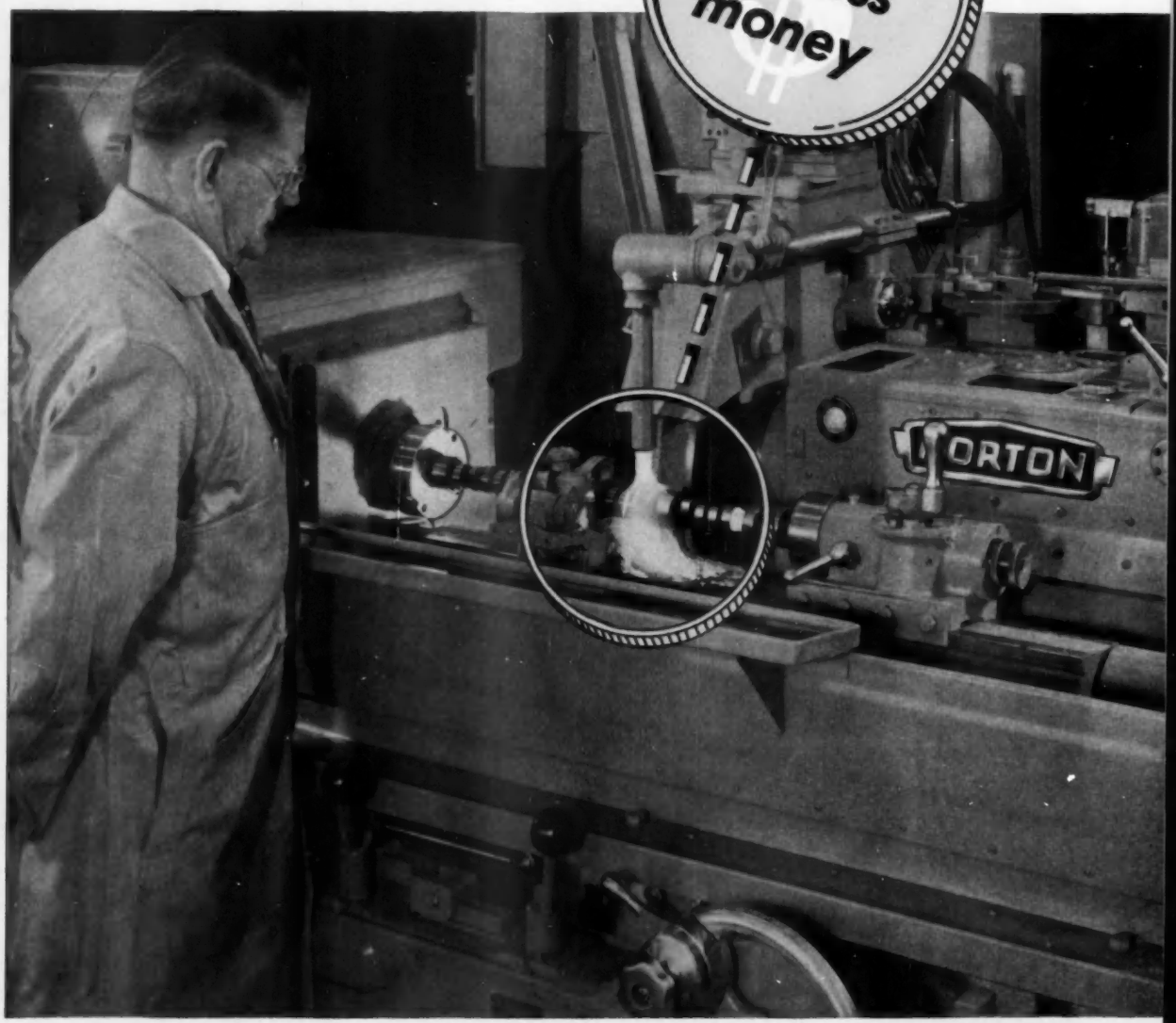
Delco-Remy

ELECTRICAL SYSTEMS

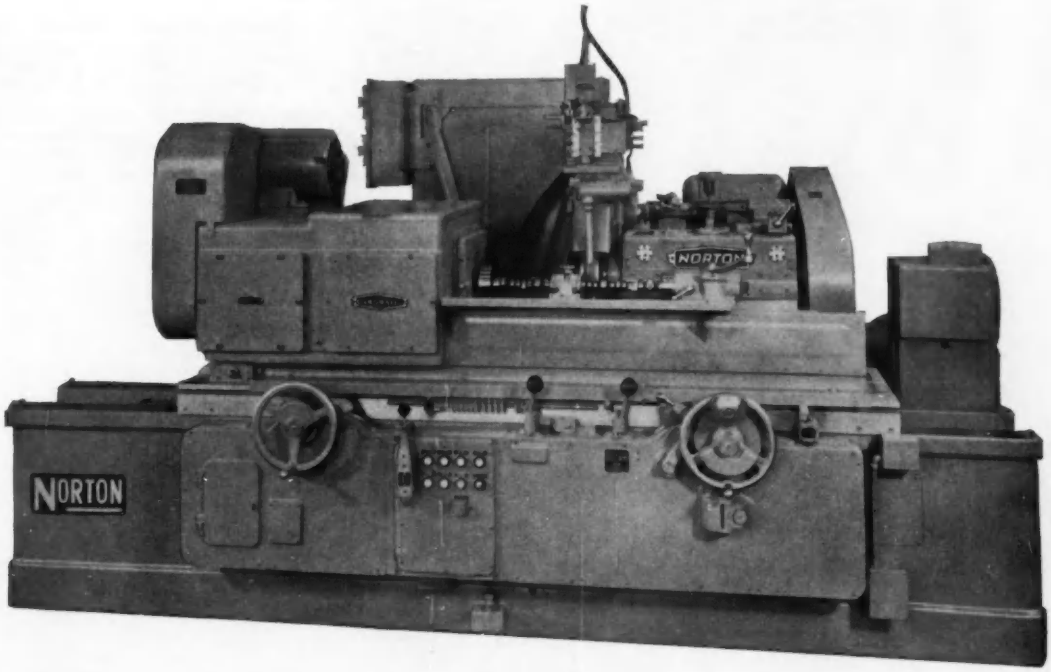
Norton's Newest!

The No. 3 CAM-O-MATIC grinds camshafts better...

and for less money



BUILT-IN OPERATING SKILL of the No. 3 CAM-O-MATIC Grinder is a typical Norton "Touch of Gold" that adds value and boosts profits. Many automatic features on this greatly improved machine reduce the operator's duties to loading and unloading. He can easily tend two or more machines — while *you* get better grinding for less money.



Highly advanced automatic grinder sets new standards for production, precision and finish

With the No. 3 CAM-O-MATIC Grinder, Norton introduces a new concept of efficiency in camshaft grinding.

No other machine of its type offers you such a combination of exclusive features, rugged construction and simplified operation. No other machine can do more towards stepping up the quality of your camshaft production, while cutting grinding time and costs.

Greater Rigidity Improves Performance

The No. 3 CAM-O-MATIC Grinder features solid, rigid construction that means minimum vibration, more accurate performance and longer service life. Another big advantage for fluid, shockless operation is that the entire operating cycle is geared to split-second efficiency. Indexing is ultra-smooth and extra-rapid. And the wheel-slide retraction after grinding each cam is no greater than maximum stock removal.

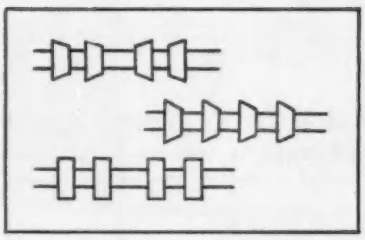
Speed is always right — automatically

The No. 3 CAM-O-MATIC Grinder's automatically compensating work speed arrangement is a valuable aid to faster, more accurate grinding. Starting with the ideal speed for rapid stock removal, it changes to exactly the right speed for fine finishing and contour accuracy — as each cam is being ground. This eliminates guesswork, manual adjustment and lost motion.

Wheel truing is automatic, too

Still another example of built-in operating skill is the wheel truing device, in which the truing diamond is automatically advanced across the wheel face and back, cutting in both directions. This is done while the operator is loading and unloading, so no time is lost. And by removing only just the amount of abrasive required for truing, the working life of every wheel is prolonged.

Your choice of tapers



The swiveling wheel slide — a Norton patent — permits grinding cam tapers in one direction (standard equipment) or tapers in opposite directions on the same shaft (an optional extra). Both arrangements permit straight-face grinding, as well — thus increasing the versatility of your camshaft production equipment.

See your Norton Representative — or write direct — for full details on the No. 3 CAM-O-MATIC Grinder. And remember, only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

To Economize, Modernize with NEW

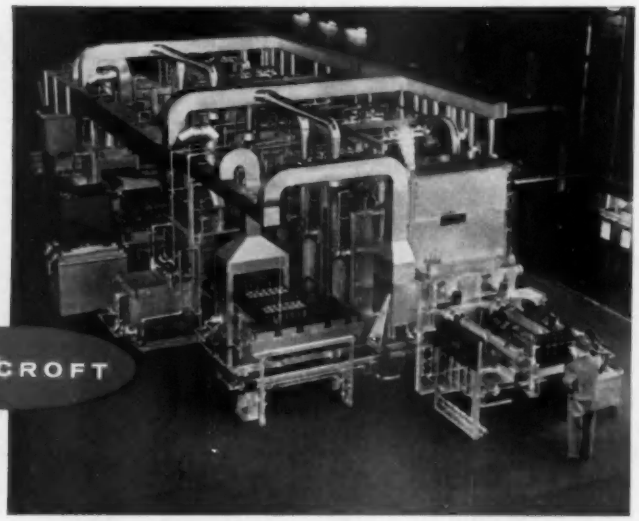
NORTON

GRINDERS and LAPPERS

Making better products... to make your products better

District Sales Offices:
Worcester • Hartford • New York Area, Teterboro, New Jersey • Cleveland • Chicago • Detroit — *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5, Ontario

BLAZING THE HEAT TREAT TRAIL— WITH HOLCROFT



LET'S TALK

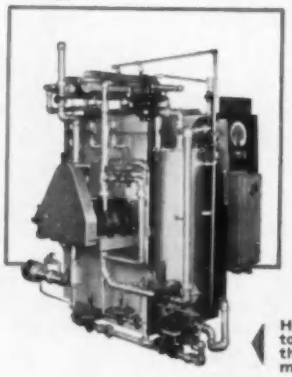
CONTROLLED ATMOSPHERES

Holcroft has pegged many of its research activities to the problems of controlled atmosphere heat treating. As a result, Holcroft has blazed the trail for industry.

Controlled atmospheres protect the stock while it is being treated and help produce the desired finish to the parts. Scale and decarburization are eliminated. Stock in the furnace chamber is surrounded by a gas atmosphere which excludes all air and products of combustion.

Basic gas generator patents go back to 1883. However, the first real use and understanding of fundamental equilibrium constants—now in general use in all gas atmosphere work—was by Holcroft in 1934. Dew point cups and equilibrium curves were furnished customers at that time. Today, Holcroft's new Lo-Dew generator (750, 1200 and 2400 cfh) provides *rated capacities* at low dew points.

Advances like these are typical of the scope of Holcroft activities—proof that you can get right answers without prejudice. Insist upon a Holcroft quotation as your first step when you have a heat treat problem. *You'll save!*



Holcroft's new gas generator designed to produce gas atmospheres between the limits of perfect combustion and modified "302".

HOLCROFT AND COMPANY

6545 EPWORTH BOULEVARD • DETROIT 10, MICHIGAN

PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • DARIEN, CONN. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • PHILADELPHIA, PA.

CANADA: Walker Metal Products, Ltd., Windsor, Ontario

CALENDAR

OF COMING SHOWS AND MEETINGS

Western Electronic Show and Convention, Los Angeles, Calif. Aug. 21-24

International Ignition Conference, sponsored by Scintilla Div. of Bendix Aviation Corp., Sidney, N. Y. .....Aug. 22-24

American Association of Motor Vehicle Administrators, annual conference, Royal Alexandra Hotel, Winnipeg, Manitoba, Canada .....Aug. 28-31

National Aircraft Show, Oklahoma City, Okla. .....Sept. 1-3

Leipzig Fair, Germany .....Sept. 2-9

Farnborough Air Show, England Sept. 3-9

Metal Powder Association, fall meeting, Homestead, Hot Springs, Va. .....Sept. 7-9

ASME Fall Meeting, Cosmopolitan Hotel, Denver, Colo. .....Sept. 10-12

SAE National Tractor Meeting and Production, Forum, Hotel Schroeder, Milwaukee, Wis. Sept. 10-13

American Die Casting Institute, annual meeting, Edgewater Beach Hotel, Chicago, Ill. Sept. 11-13

Packaging Machinery & Materials Exposition, Public Auditorium, Cleveland, O. ..... Sept. 11-14

National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J. .....Sept. 12-14

American Chemical Society, annual meeting, Atlantic City, N. J. Sept. 16-21

Instrument - Automation Conference and Exhibit, Coliseum, New York, N. Y. ..... Sept. 17-21

International Commercial Motor Transport Show, Earls Court, London, England .....Sept. 21-29

ASME Petroleum-Mechanical Engineering Conference, Conrad Hilton Hotel, Dallas Tex...Sept. 23-26

Trade Fair of the Atomic Industry, Navy Pier, Chicago, Ill.....Sept. 24-28

Atomic Industrial Conference Forum, Morrison Hotel, Chicago, Ill. .....Sept. 25-27

National Electronics Conference, Hotel Sherman, Chicago, Ill..Oct 1-3

AIEE Fall General Meeting, Morrison Hotel, Chicago, Ill.....Oct. 1-5

Standards Engineers Society, Hotel Willard, Washington, D. C...Oct. 3-5

SAE National Aeronautic Meeting, Production Forum, and Engineering Display, Hotel Statler, Los Angeles, Calif.....Oct. 2-6

Paris Automobile Show, France..Oct. 4-14

ASME - ASLE Third Lubrication Conference, Chalfonte-Haddon Hall, Atlantic City, N. J....Oct. 8-10

National Metal Exposition, Public Auditorium, Cleveland, O. Oct. 8-12

Material Handling Institute, fall meeting, Traymore Hotel, Atlantic City, N. J.....Oct. 10-11

SAE National Transportation Meeting, Hotel New Yorker, New York, N. Y. .....Oct. 10-12

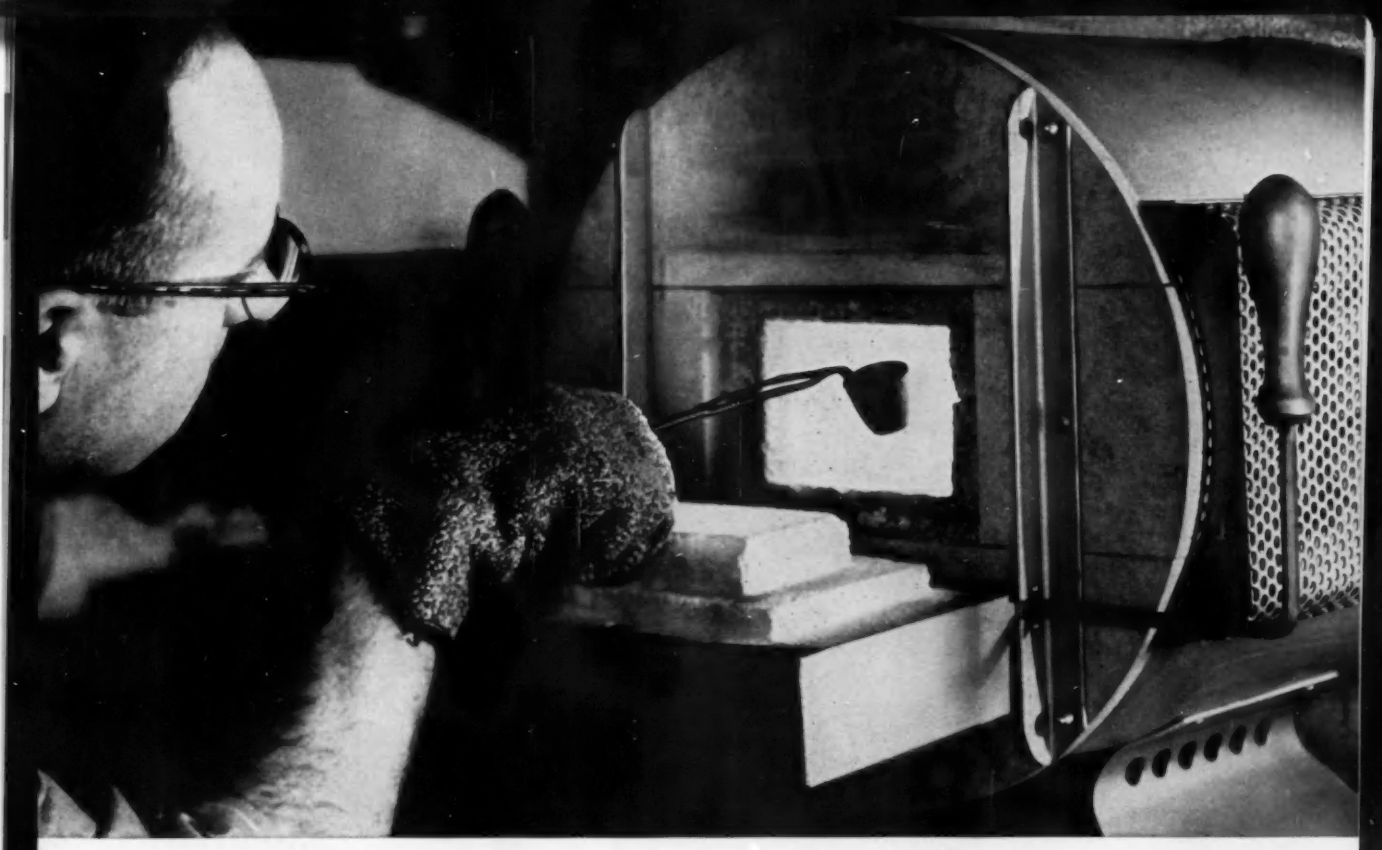
American Society of Body Engineers, annual convention, Rackham Bldg., Detroit, Mich...Oct. 17-19

International Motor Show, Earls Court, London, England...Oct. 17-27

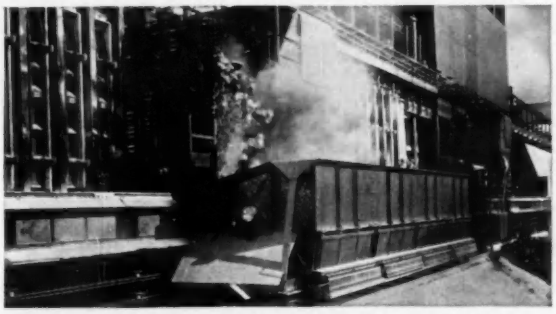
National Industrial Exposition & Management Conferences, Artillery Armory, Detroit, Mich. Oct. 22-26

National Automobile Show, Coliseum, New York, N. Y.....Dec. 8-16

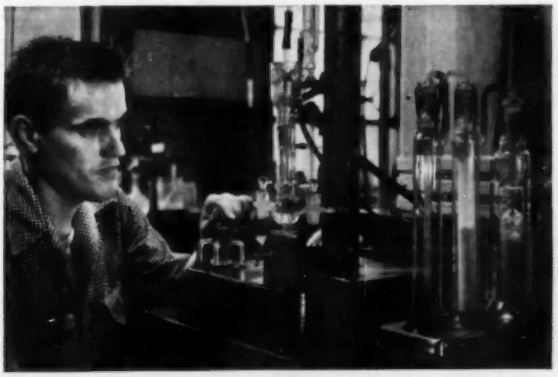
OUR POWER-STEERED



How Great Lakes Steel *blends* quality



COKE OVENS eject tons of flaming, quality controlled coke into cars for rapid delivery to quencher. Then . . .



SAMPLES ARE ANALYZED carefully to determine the amount of sulphur in the coke used in the blast furnaces.

Take five kinds of carefully selected soft coal. Blend well. Bake in a 2500° oven for 15½ hours. And if every step has been checked and double checked, the way it is at Great Lakes Steel, *presto!* You get pure, hard coke—the vital ingredient for reducing ore to high-quality pig iron.

Above, you see Great Lakes special coke recipe (cut in millionths, of course) being checked for ash impurities, a very important step in the complete analysis.

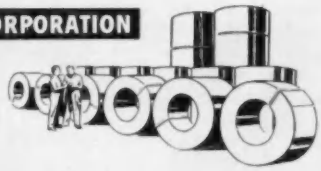
First, a sample of each kind of coal is burned to a cinder in the test furnace. Then the painstakingly mixed blend gets this dress rehearsal heat treatment, too. And this makes doubly sure that the blast furnaces produce quality iron . . . iron to make steel that meets customer specifications *to the letter!*

Quality control from raw materials to finished product—that's Great Lakes Steel! May we help you?

GREAT LAKES STEEL CORPORATION

Ecorse, Detroit 29, Michigan • A Unit of

NATIONAL STEEL CORPORATION



District Sales Offices: Boston, Chicago, Cincinnati, Cleveland, Grand Rapids, Houston, Indianapolis, Lansing, Los Angeles, New York City, Philadelphia, Pittsburgh, Rochester, St. Louis, San Francisco, Toledo, Toronto.

SURE, POWER STEERING MAKES THE JOB EASIER. BUT IT'S THE ADDED SAFETY THAT COUNTS MOST.
OUR POWER-STEERED RIGS STAY ON SCHEDULE BETTER, TOO.
EITHER WAY, POWER STEERING MAKES GOOD BUSINESS SENSE.

THE CASE FOR POWER STEERING ON TRUCKS!

The trend to power steering on trucks is based on one very practical reason —operators of trucks equipped with power steering have invariably found that the added safety and greater operating efficiency of their vehicles have demonstrated that power steering is indeed a sound investment.

Truck drivers using power steering report less tension and fatigue in normal driving and appreciate the positive control that blocks road shock from chuck holes and prevents loss of control if the truck is forced out on a soft shoulder.

The dispatcher knows the importance of regularly maintained schedules. He is quite aware that with power steering drivers are more relaxed and are better drivers than tired drivers. Thus, power steering not only reduces the hazard of road accidents, but helps the driver to maintain established schedules through better vehicle control.

In short, power steering, by saving time and money, contributes materially to a more profitable operation.

Truck manufacturers are always eager to offer their customers features that will make truck operation safer and more profitable and, at the same time, give their dealers every selling advantage.

That's why more and more truck manufacturers are offering performance-proven Bendix Power Steering as original factory equipment.

If you would like to know why power steering for trucks is perhaps even more logical than power steering for passenger cars, we have prepared an interesting folder on the subject.

Write for your copy today. We think you'll be convinced.

Bendix PRODUCTS DIVISION South Bend IND.

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AVIATION CORPORATION

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High Spots of This Issue

★ **New Final Assembly Methods Used for F4D-1 Fighter Plane**

Douglas Aircraft Co. came up with an entirely new concept in production methods for final assembly of the Navy Skyray supersonic fighter. Described and illustrated here are the rather unique techniques employed throughout the project. Page 48.

★ **Shot Blasting Hot Rolled Steel for Car Components**

Installation of a Pangborn Rotoblast descaling machine and allied equipment has proved a boon to Oldsmobile in holding down descaling costs. How the equipment is set up and its operating details make a story well worth telling. Page 54.

★ **Polish Automotive Plants Tooled With Russian Machines**

In all fairness, it must be admitted that the building of a motor vehicle industry in Poland from scratch during the past 10 years is nothing short of miraculous. This behind-the-scenes report analyses its rise and present status. Page 60.

★ **Automatic Buffing and Substitute Operations**

Keyed to meet a continuous hungry demand for plated bright work on today's cars is the new Syracuse, N. Y., plant of the GM Brown-Lipe-Chapin Div. The author conducts the reader on a graphic tour of plant's modern facilities. Page 62.

★ **Mass Marquenching of Truck Transmission Parts**

Heat treating facilities at the Fort Wayne Works of International Harvester Co. have been modernized to the tune of $1 million plus. Pivotal point of the new installation is the development of a new "mass marquenching" method. Page 66.

★ **38 New Product Items And Other High Spots, Such As:**

Huge forming press; choosing plastic dies; Orion engine; new aircraft developments; aircraft production training; Meteor fuel injector; future automotive materials; and unanswered Curtiss-Wright and Studebaker-Packard questions.

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Automotive and Aviation News, Page 33

AUTOMOTIVE INDUSTRIES COVERS
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES • BODIES • TRAILERS • ROAD MACHINERY • FARM MACHINERY • PARTS AND COMPONENTS • ACCESSORIES • PRODUCTION EQUIPMENT SERVICE EQUIPMENT • MAINTENANCE EQUIPMENT
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News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 115, No. 4 August 15, 1956

Nucleus Sales Group Being Set Up For Ford's 'E' Car

Although Ford's new "E" car is not expected to be introduced for some time, the company already has started the vast machinery rolling in setting up a sales organization to handle the new car.

Among the first steps to be taken next month will be the formation of five regional sales offices in strategic areas around the country. These will include Chicago, Detroit, Newark, N. J., New Orleans and San Francisco, which will represent the nucleus of a nationwide organization for marketing the car. In addition, district offices in all sections of the country will be reactivated starting early next year.

Managers for the new regional offices also already have been selected. Whether the company will set up a complete new dealer organization to market the new car or select certain dealers from its present dealer body is not known at this time.

Cadillac Takes Over Old Plant Of Hudson for Sheet Metal Work

Cadillac has purchased the former Hudson plant near Gratiot Ave. and Conner St. on Detroit's east side. The purchase includes the property, buildings, roadways and parking lots.

The facility will add one million sq ft of floor space to Cadillac's facilities to bring the Division's total manufacturing floor space to more than five million sq ft. The added space will be used primarily for Cadillac's sheet metal fabrication operations.

The plant was built in 1925 and was utilized for the manufacture of automobiles up until two years ago, when the Hudson car manufacturing operations were moved to Kenosha, Wis. The property subsequently was purchased by an independent investment group, Hudson-Detroit Associates, from whom Cadillac purchased the facility.

The plant will be completely renovated, rehabilitated, and modernized before new machines and equipment are moved in for the Cadillac operation. One building has been under lease to Cadillac since last March. It has been modernized and houses a portion of the Division's small parts fabrication operation.

The remainder of the plant is now being renovated and modernized and is expected to be ready for full operation by the fall of 1957.

Chrysler "Norseman" experimental car lost in sinking of the liner Andrea Doria.

Chrysler 'Idea' Car Lost In Italian Liner Sinking

With the sinking last month of the Italian Liner *Andrea Doria*, Chrysler Corp. lost one of its most advanced styled experimental cars (see illustration). It was being shipped from Italy to this country for its debut at the National Automobile Show in New York in December.

Called the "Norseman," the car featured a number of highly advanced styling and engineering innovations, including an interesting new treatment in curved window structure. It had no posts or pillars to support the roof, thus eliminating all obstructions.

The unique design was possible through the use of a cantilever roof which curved upward from the rear and over the passenger compartment. The only interruptions in the glass around the entire body were two steel arches curving upward from the rear.

Four pieces of transparent plastic, two at the extreme ends of the wrap-around windshield and one on each of the two side windows, served as the vertical window "channels." The car featured a 12 sq ft, power-operated rear window which could be raised forward and under the roof panel on the interior.

All major parts of the car were made of aluminum, and headlights, door handles and trunk-lid opening device were concealed. Overall length was 227½ in.; wheelbase, 129 in.; height, 57 in.; and width, 80 in. The corporation has not decided whether it will build a duplicate model of the car, which took more than two years to design and construct.

News of the AUTOMOTIVE

BALL BEARING MEASUREMENT

Depicted in use at Chance Vought Aircraft, Inc., is this new Sheffield Radial Play air gage. It has become a standardized instrument for simplifying and speeding checking of internal clearances between inner and outer rings of ball bearings used in the automotive, aircraft and other precision industries. At the inspector's press of a pedal, a controlled air stream does the measurement job. Sheffield column Precisionaire at right aids in checking radial play.

West Coast Aircraft Industry Piles Up Large Order Backlog

The recent $200 million order for Convair short-range jet airliners marks the beginning of a new series of orders for the Pacific Coast. Aircraft manufacturers there already dominate in a big way the world market for both piston and turbine-powered transports.

Of the 1175 planes now on order for airlines throughout the world, the West Cost aircraft industry has firm contracts for 1025 at a $2.5 billion cost. The new short-range jet airliner business will boost the backlog and assure the industry's 50,000 subcontractors and suppliers across the country of steady work for years.

Ford Earnings In First Half Drop 45 Per Cent Under 1955

Although sales by Ford Motor Co. in the first six months of this year declined 18.2 per cent, earnings for the period tumbled by nearly 45 per cent to $131.70 million from $234.4 million in the first half of last year. Biggest factors contributing to the decline in earnings, in addition to a 23.6 per cent drop in the number of cars and trucks sold, were heavy expenditures for new facilities and new product programs. Included was the setting up of a nucleus organization for the new "E" car, which is expected to be introduced late next year.

Sales totaling $2.364 billion were the second highest for any first half period, topped only by last year's $2.891 billion, and they exceeded by six per cent the $2.231 billion in the first half of 1954. The company did not report volume of defense sales, but indicated they were under last year, although the percentage decline was not as great as civilian sales. For the entire year of 1955, Government sales amounted to $259 million, and there was a $700 million backlog of such orders at the end of the year.

While total factory sales of cars and trucks again topped the one million mark, sluggish automobile sales in the second quarter, experienced by the entire industry, reduced car sales in the six-month period to 868,266 units. In the same period last year. Ford car sales totaled 1,151,369. Of the total, 1,028,284 cars and trucks turned out by Ford in the first half, 523,392 were sold in the first three months and 504,892 in the second quarter.

Payrolls in the first six months, the second best on record for a first half period, totaled $489.5 million, and were topped only by the $538.6 million in the first half of last year. Average employment declined by only slightly more than 1000 persons from the 1955 first half in totaling 177,168 against 178,438 last year.

GM's $503 Million Net Seen Second Best for First Half

Sales by General Motors Corp. for the first six months were the second best on record, despite a 14 per cent drop in factory sales of cars and trucks and a sharp reduction in defense volume. The corporation reported total sales of $5.869 billion, compared with the record $6.513 billion in the like period last year.

Net income declined to $503 million from $661 million in the first half of 1955. Defense sales of $260 million represented 4½ per cent of total sales, against $557 million in the previous year.

Although car sales in the first quarter remained at a relatively high level, a decline in retail sales during the second quarter necessitated a continuous revision of production schedules. The result was that U. S. car and truck production by GM declined to 1,983,720 units in the first half. In the same period last year, GM turned out 2,314,475 cars and trucks.

Production by GM's overseas plants, on the other hand, was slightly ahead of the record total last year, as output totaled 207,362 against 192,221 in 1955. The total does not include output of GM's Canadian plants.

The six-month financial report showed that GM's world-wide employment averaged 617,302 persons compared with an average of 624,954 last year, with payrolls totalling $1.44 billion. Both employment and payrolls were at the second highest levels for the first-half of a year.

Chevrolet Plant Builds One Millionth V-8 Engine

A milestone was marked by Chevrolet on July 18 with the production of the millionth V-8 engine at the division's Van Slyke plant near Flint, Mich. The plant, which built its first engine in July, 1954, turns out V-8's for both cars and trucks.

Chevrolet currently is installing V-8 engines in approximately 60 per cent of its cars, compared with 43 per cent for the entire 1955 model year. The division operates another V-8 facility in Tonawanda, N. Y.

AND AVIATION INDUSTRIES

Chrysler Six-Month Net Drops To $18.6 Million

Chrysler Corp.'s financial report for the first six months of this year shows that although car and truck production dropped by 34 per cent, the company's share of the total industry retail market dipped only 0.8 per cent under last year's total of 17.1 per cent to 16.3 per cent. The corporation's sharp drop in production compared with Ford's decline of 23.6 per cent and GM's 14 per cent for the same period this year.

Chrysler wound up the first half with earnings of $18.67 million, a sharp decline from the $70.01 million in the same period last year. Sales totaling $1.42 billion were the third best on record and compared with $1.88 billion in the comparable period in 1955.

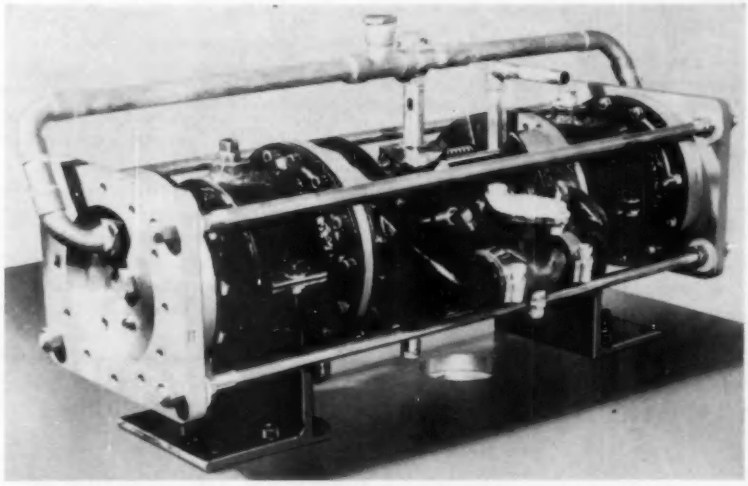
Factory shipments of cars and trucks in the January-June period totaled 592,501 units, against 900,546 during the same time last year. Capital outlay for such items as land, machinery, and buildings approximated $37.4 million during the first half, somewhat under last year's $53.4 million. Expenditures in the next six months are expected to be considerably higher.

Unlike General Motors and Ford, Chrysler's defense volume was substantially ahead of that in the 1955 six-month period in totaling $110 million against $70 million a year earlier. The defense volume accounted for eight per cent of total sales, compared with four per cent last year. Chrysler's defense activities comprise several important missile projects, including the intermediate range ballistic missile, the "Jupiter."

Cadillac Brougham Debut Is Delayed for Some Time

The Cadillac Brougham, ultra-plush model designed to challenge the Continental, has been delayed again. It now looks as though it may not be available until some time after the first of next year.

It will be shown at the National Automobile Show in New York in December, however. Fuel injection still is a likely possibility.



Ford experimental free piston engine is adapted to run on many kinds of fuels.

300,000th Four-Door Hardtop Was Built By Buick in July

The four-door hardtop continues to enjoy healthy sales. Buick, which started production on that body style about 16 months ago, reports that it built the 300,000th unit last month (July).

Although the division did not indicate what share of the total market that figure represented, it said that production of all hardtops (including two-door models), in the first six months totaled 218,000 units. The division has turned out 1.5 million hardtops since it introduced the first.

'Packaged' Free Piston Engine Is Foreseen By Ford Engineer

A comment by Paul Klotsch of Ford's Scientific Laboratory that the free piston engine may be marketed some day as a "packaged" unit, with the entire lubrication system sealed into it, illustrates the company's optimism about that type of power plant. The potential advantages of the engine are leading many industry observers to hint that the gas turbine compressor system may be by-passed in favor of the free piston unit. Noise level of the free piston engine, which increases with heavier loads, and more effective controls, are among the problems yet to be solved.

Biggest advantage of the free piston engine is that it can operate on almost any kind of fuel, including propane gas, Diesel oils and low-octane gasoline. Unlike the gas turbine, the free piston engine does not require critical metals with high nickel content. Most of the parts for Ford's free piston power plant (see illustration) were made of low-alloy steels.

Reports of $200 Price Boosts On '57 Cars Seen Exaggerated

Undoubtedly, 1957 cars will cost more than 1956's, but reports of planned increases ranging from $100 to $200 seem exaggerated. Higher steel prices and other increased costs will be passed on, of course. However, the total increase should not be anywhere near the $100 to $200 figures being mentioned, unless certain equipment now optional is made standard. An $8 per ton increase in steel cost would add only about $16 to the price of an average automobile, which uses about two tons of steel.

One '57 Car May Offer A Special AM-FM Radio

Under consideration for one of the 1957 medium priced cars is an AM-FM radio. Principal advantage would be reception of TV audio so that motorists at least could listen to their favorite TV programs.

News of the AUTOMOTIVE

Headlamps Located in Bumpers Under Study By Car Producers

Sealed beam lamps integrated into front bumpers are under study. These dual lights, which would also serve as fog lamps, would be in addition to headlights located elsewhere.

"Straight Stick" Transmission May Cost Extra on 1957 Cars

One of the "Big Three" automobile manufacturers is reported considering making the automatic transmission standard equipment in its largest volume line. The partciular division involved has a more advanced type automatic drive coming next year which it might make optional at extra cost and offer the present automatic as standard equipment.

There also is some conjecture in Detroit that "straight stick" transmissions soon may be an extra cost item—particularly in makes where the automatic transmission accounts for a very high percentage of output.

1956 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

	For Weeks Ending				Total Jan. 1 to Aug. 4, 1956
	August 4	July 28	July 21	July 14	
PASSENGER CAR PRODUCTION					
Hudson	314	296	356	242	19,657
Nash	1,089	1,140	980	1,040	47,674
Total—American Motors	1,403	1,436	1,336	1,282	67,331
Chrysler and Imperial	2,275	1,699	2,538	2,775	76,247
De Soto	1,682	689	1,940	2,041	64,943
Dodge	5,476	4,426	4,197	4,224	130,290
Plymouth	9,797	9,855	9,518	9,038	298,865
Total—Chrysler Corp.	19,230	16,669	18,193	18,078	580,345
Ford	28,312	28,527	28,542	28,719	834,795
Lincoln and Continental	371	1,051	1,133	1,082	33,096
Mercury	5,060	6,439	6,307	5,999	166,711
Total—Ford Motor Company	33,743	36,017	35,982	35,800	1,034,602
Buick	9,555	9,515	9,899	9,878	364,711
Cadillac	3,048	3,151	3,216	3,218	90,036
Chevrolet	29,600	29,811	30,120	29,356	1,041,400
Oldsmobile	7,935	8,109	8,125	7,975	288,216
Pontiac	5,597	5,490	5,064	5,652	216,255
Total—General Motors Corp.	55,735	56,076	56,724	56,077	1,981,618
Packard	0	0	0	0	13,289
Studebaker	848	1,140	1,181	1,527	51,836
Total—Studebaker-Packard Corp.	848	1,140	1,181	1,527	65,125
Checker Cab	56	104	119	100	2,149
Total—Passenger Cars	111,015	111,442	113,535	112,864	3,711,170
TRUCK PRODUCTION					
Available	10	9	3	0	236
Chevrolet	7,121	6,602	6,924	7,129	226,001
G.M.C.	1,722	1,703	1,539	1,546	58,564
Diamond T	100	108	105	110	3,047
Divco	60	74	80	0	2,393
Dodge and Fargo	2,045	1,866	2,111	1,821	55,118
Ford	6,381	6,240	6,074	6,168	189,577
International	2,320	2,379	2,374	2,109	64,218
Mack	312	408	308	286	11,209
Marmon-Herrington	30	27	25	22	380
Reo	92	96	78	76	2,317
Studebaker	460	484	412	341	9,773
White	35	45	359	333	10,660
Willys	0	1,309	1,167	1,381	35,811
Other Trucks	116	133	142	138	4,533
Total—Trucks	20,803	21,483	21,701	21,437	694,039
Buses	94	92	89	106	2,668
Total—Motor Vehicles	131,912	133,017	135,325	134,407	4,407,897

Lincoln, Continental Linked Into One Separate Division

The final step in separating all Lincoln and Continental sales activities from the Mercury Div. was taken last month. The Lincoln and Continental divisions were consolidated into one organization to be known as the "Lincoln Div." (see AI, Aug. 1, p. 37).

Ford Motor Co. feels that the Continental program has reached a point where duplicate administrative functions are unnecessary, and has established a new field organization to manage the sale of both the Lincoln and Continental cars. Until now, both cars have been merchandised through the Mercury Div. field sales group.

The two cars, however, will continue to be made at separate plants —the Continental at the new plant in Ecorse Township near Dearborn, and the Lincoln at the Wayne, Mich., plant, which also builds Mercury cars. The Lincoln will be produced at the Wayne plant until the 1958 model run, when it will then move into a new plant now under construction at Novi, Mich.

General manager of the new Lincoln Division is Ben D. Mills. Under the new field organizational setup, 13 district sales offices will be established, with 55 resident zone managers assisting the 1450 dealers handling either the Lincoln or Continental, or both. District managers will report directly to Henry B. Daniels, general sales manager of the new Lincoln Div.

Case, Oliver Reported Studying Plan To Merge

With many smaller farm equipment companies operating on deficits since the beginning of the year as a result of declining sales, new merger moves are being considered as possible solutions to the problems which have vexed them. Two companies which have remained in the red this year are J. I. Case, of Wisconsin, which suffered a net loss of $4.7 million in the first six months, and Oliver Corp., of Battle Creek, Mich., which had a $221,000 deficit.

Both companies reportedly are now considering plans to merge. Details have not yet been worked out.

AND AVIATION INDUSTRIES

GIANT STAINLESS TANK

This dramatic photo shows a welder connecting throat section to shell of offset semi-trailer tank made of stainless steel at U. S. Steel Products Div. Wooden frames hold the tank in shape during welding, while plastic envelope protects mirror-like exterior and interior surfaces during fabrication. The 40-ft, 6500-gal tank is now in service.

Engine Displacements Reduced For Indianapolis Race Entries

Now that an adequate supply of the necessary new engine parts has been assured for all car owners in time for next year's 500-mile race, the Indianapolis Motor Speedway has announced a cut today in the piston displacement for the 1957 classic.

The new specifications, which also will remain in effect for the 1958 and 1959 Indianapolis races, reduce the maximum size of non-supercharged engines from 274 cu in. to 256 cu in. and cut supercharged engines from 183 cu in. to 171 cu in. Diesel engines up to a maximum displacement of 335 cu in. and turbine engines of unlimited size will be eligible again in 1957, as they were this year.

Engines up to 600 cu in. were permitted for the first 500-mile race in 1911. This figure was cut to 450 in 1913, 300 in 1915, 183 in 1920, 122 in 1923 and 91.5 in 1926. For eight straight races, beginning in 1930, the Indianapolis Classic was open to engines up to 366 in. but the "unblown 274" and "blown 183" rules have prevailed since 1938.

AI TABLOID

Leece-Neville Co. has launched an intensive program to double its current sales volume of small motors.

* * *

American Brake Shoe Co. is establishing a subsidiary in Mexico for the manufacture of automotive, truck and bus brake lining.

* * *

Westinghouse Electric Corp. plans to construct a transformer plant in Athens, Ga. . . . Square D Co. will build a $3 million electrical equipment plant in Lexington, Ky.

* * *

Republic Aviation Corp. has named its F-105 fighter-bomber the "Thunderchief."

* * *

Joseph T. Ryerson & Son, Inc., has changed the name of the Ryertex-Glyco Div. to the Industrial Plastics and Bearings Div.

* * *

Vanadium Corp. of America has moved its Engineering Dept. from Niagara Falls, N. Y., to new facilities at Cambridge, O. . . . Industrial Retaining Ring Co. has moved to 57 Cordier St., Irvington, N. J.

* * *

Texas Co. has released a new color film entitled "Cutting Fluids."

* * *

General Motors Corp. is considering building a truck factory in Brazil.

* * *

Morris P. Kirk & Son, Inc., has acquired controlling interest of Pioneer Aluminum, Inc.

* * *

Aerojet-General Corp. has formed a new subsidiary—Aerojet-General Nucleonics—with offices in Walnut Creek, Calif.

New Departure Div. of General Motors Corp. will observe 50 years as a manufacturer of precision ball bearings during the week of Sept. 9.

* * *

Goodyear Tire & Rubber Co.'s new multi-million dollar distribution center near Cleveland Airport is scheduled for completion in November.

* * *

Mack Trucks, Inc., is acquiring the facilities of Brockway Motor Co., Inc. The latter will be operated as a division of Mack.

* * *

Allegheny Ludlum Steel Corp. has contracted to purchase Paul R. Repath, Inc., of Los Angeles, Calif. The latter is a producer of electrical steel laminations, metal stampings, and deep drawn transformer cans.

* * *

LeTourneau-Westinghouse Co. is undertaking a $9 million building and tooling program.

* * *

Kaiser Aluminum & Chemical Sales, Inc., has established a new branch office in Omaha, Neb. . . . Lord Manufacturing Co. has opened new field offices in Boston and in Cleveland.

* * *

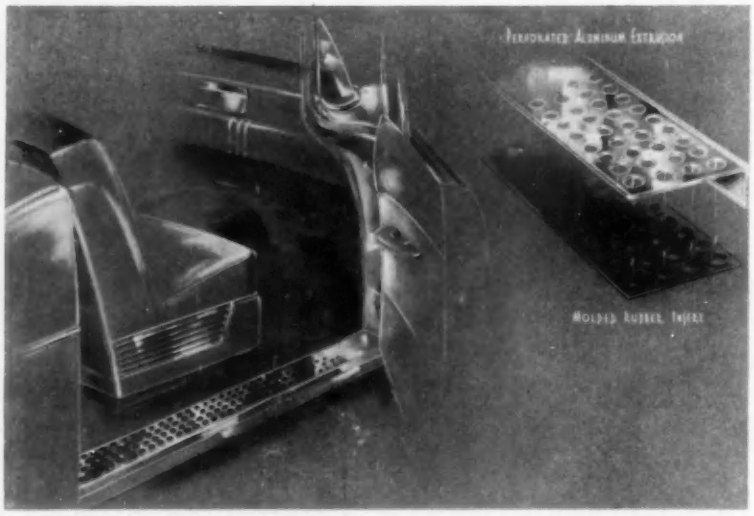
North American Aviation, Inc., is developing a new two-place jet trainer for the Navy. . . . Vertol Aircraft Corp. has received a contract for more than $1.8 million to develop gas-turbine-powered helicopters for the Navy.

* * *

Metal Powder Association is occupying new offices at 130 West 42nd St., New York 36, N. Y. . . . Flodar Corp. has moved to larger quarters at 16911 St. Clair Ave., Cleveland, O.

(*Turn to page* 170, *please*)

News of the AUTOMOTIVE



FUTURISTIC ALUMINUM SILL MAT MARKED BY BEAUTY

Presented above is an interesting design idea for an automobile of tomorrow—a perforated aluminum sill mat with a molded rubber insert. Raised portions of the rubber extend through the perforations to afford good traction and provide an eye-catching styling effect. The drawing is the latest in a series of sketches for the use of aluminum in automobiles from the Automotive Market Div. of Reynolds Metals Co.

Expansion To Double Space At Ford Atlanta Plant Facility

Ford Div. will nearly double the space at its Atlanta, Ga., assembly plant as part of a $100 million expansion program in the South. The increased space will not boost actual car unit capacity, although 407,000 sq ft of space will be added.

The extra area will be used for material handling and assembly space. This has become necessary as a result of the great increase in variety of equipment options and models being offered.

Chrysler Service Center Now In Full Operation

Chrysler's modern new 85,000 sq ft Technical Service Training Center at Detroit now is in operation. All vehicle divisions have their own rooms fully equipped for training mechanics. The Central Service Section also has complete facilities for training, "flat rate" studies, and developing repair techniques.

Mechanics from fleets using Chrysler products and from independent repair shops also will be eligible to attend the Center upon application through MoPar distributors. The Chrysler Training Center system probably will be extended later.

New Type Cab for Jeeps Being Offered By Willys

A new enclosure for the civilian Jeep is now being produced by Willys. Although cabs have been available for Jeeps in the past, this is the first time that Willys itself is producing the unit.

Constructed of steel with a reinforced plastic top, the cab is available with either hinged or sliding doors. It has a locking rear door which slides into the top of the enclosure.

Ross Gear and Gemmer Approve Merger Plans

Stockholders last month approved the merger of Ross Gear and Tool Co., Inc., Lafayette, Ind., and Gemmer Manufacturing Co., Detroit. The merger still has to be approved by Ross Gear board of directors. Under the terms, Gemmer would operate as a division of Ross.

Manual Transmission Readied For Corvette

Chevrolet is developing an improved four-speed synchromesh transmission for the Corvette. It will reportedly answer criticisms of some sport car fans who insist that a true sports car should have the "straight stick" type transmission.

$9.8 Million Air Force Job Awarded To AC Spark Plug

AC Spark Plug Div. has received a $9.84 million order to repair and modify Air Force bombing navigational computers. Work on the complex computer systems, which contain 60,000 parts each, will be done at the Milwaukee and Flint, Mich., plants.

Chevrolet Adds Two Regions In Expansion of Sales Force

In preparation for a possible upswing in new car sales and what one official describes as the return of "competitive normalcy," several car companies have been realigning and expanding their field sales forces. Possible solutions to weak marketing spots in certain sections of the country have also been examined.

Chevrolet last month said it would add two new regions in a nationwide expansion of its wholesale forces, to bring to 10 the number of such regions around the country. The number of new zones also will be increased by five to boost the total to 47.

The two new regional offices will be established in Cincinnati and Denver. The Cincinnati region will be made up of five zones—three zones from existing regions and two new zones—while the Denver office will supervise five zones which now report to other regional headquarters.

New zone offices will be set up in Newark, N. J., Charleston, W. Va., South Bend, Ind., Peoria, Ill., and Green Bay, Wis. Biggest advantage of the new realignment (scheduled to be completed by Oct. 1), is that it will provide car dealers with greater specialized assistance on business management, service and other technical problems, in addition to every phase of merchandising.

AND AVIATION INDUSTRIES

Ford Carburetor Laboratory In Operation at Dearborn

A new carburetor laboratory completed by Ford recently in the company's Research and Engineering Center in Dearborn will provide expanded facilities for testing carburetors, air cleaners, manifolds and other induction system components. It will also contribute importantly toward research work on fuel injection systems. The laboratory contains five special rooms equipped with fuel and air flow measuring stands on which carburetors are operated in controlled atmospheres.

Various actual driving conditions, ranging from sea level to a 10,000 ft altitude and from idle speed to full throttle, can be simulated in the new facility. The stands hold refrigerator-sized, tempered-glass enclosures where equal mixtures of fuel and air are "fed" into various types of carburetors — after vacuum conditions have been created—for making accurate comparisons.

Shareholders Approve Merger Of Bearings Firm With Mogul

Final stockholder approval was given to a plan to merge Federal-Mogul-Bower Bearings, Inc., with National Motor Bearing Company, Inc. Under terms of the merger, National Motor Bearing will be operated as the National Seal Div. of Federal-Mogul-Bower with its basic organizational structure remaining unchanged.

Outlook for Piasecki Aircraft Seen Favorable in Years Ahead

Piasecki Aircraft Corp. is currently working on 11 prime contracts for the Armed Services and has additional proposals under evaluation. Organized in June, 1955, Piasecki Aircraft became a publicly owned company this year.

Current operations of Piasecki Aircraft include contracts for the Armed Services on: a design for VTOL aircraft eliminating the helicopter-type rotor; the "Sea Bat," a drone helicopter for special military purposes; design of a giant "flying crane" helicopter; a mine countermeasure system; and the design, construction, and testing of a low-maintenance helicopter rotor. Other projects are under development.

LIGHT COMMUNIST CAR SCHEDULED FOR PRODUCTION

Russian Byelka (Squirrel) is powered by a two-cylinder, aircooled, 20-hp rear engine. Prototypes of the 1630-lb car are now under test, and production is planned for the near future. Also under development is a utility version that is an open model with a removable rear seat for conversion to a light pick-up vehicle.

Detachable Crash Pad Studied By Car Makers

An interesting innovation in safety crash pads for cars is being explored by two of the "Big Three" car companies. It is a padded "apron" which is hinged to the instrument panel in front of the "death seat."

It swings out over the lap of the occupant and protrudes about nine in. from the dash. When not in use, it is swung above the windshield.

Composite Die Casting Concern Is Formed in Detroit by Puffer

Ajax Composite Die Co. is name of a new corporation formed in Detroit to produce composite dies, recently discontinued by the Ajax Steel and Forge Co. Headed by K. J. Puffer, the new company is located at 12900 Auburn Ave.

Chrysler Buys 1700-Acre Site For Possible Research Center

The recent decision of Chrysler Corp. to purchase 1700 acres of property in Troy Township northeast of Detroit indicates that plans may be afoot for construction of a research facility similar to the new GM Technical Center.

Chrysler gave no specific details about its plans for the site. It merely said that the property will be held for "possible future expansion of engineering and research facilities." No building is planned at present.

Towmotor Seeking to Acquire Gerlinger Carrier of Dallas

Towmotor Corp. is seeking to acquire Gerlinger Carrier Co. of Dallas, Ore. Acquisition of the firm would give Towmotor a broader line of lift trucks, ranging from 10,000 to 40,000 lb in load capacity. It would also put the company into the business of making straddle-type industrial trucks produced by Gerlinger.

Continued on Page 94

Meeting the big change in cars with the big change in bearings:

TIMKEN® and The Moto-Mated Way

New TIMKEN Moto-Mated bearings are smaller, permit more compact designs

FROM a revolutionary new kind of bearing plant comes a new breed of bearings—the product of an entirely new concept in bearing design, production and supply *mated* to the new needs of the auto industry. It's the Timken Company's Moto-Mated Way.

The new Timken® Moto-Mated tapered roller bearings are smaller, permitting more compact car designs and savings in lubricant. They're lighter, cutting unsprung weight to provide a more comfortable ride. In front wheels, for example, they cost 11.3% less than previous designs. They're lower cost because they're made in a new kind of plant that uses advanced production methods new to the bearing industry. They take the increased loads of today's power cars in stride by packing maximum capacity into minimum space. And they're *available* in almost unlimited supply.

By adopting new standardized Timken Moto-Mated bearing sizes for front wheels, the auto industry has helped make present savings possible. Additional savings will result when the new Moto-Mated sizes are adopted for rear wheels, pinions and differentials.

Whether your immediate concern is automotive design, production or purchasing, you stand to benefit from Timken and the Moto-Mated Way. Our engineers are ready to help you adapt your designs to the new Timken Moto-Mated bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO".

QUALITY, SERVICE, PUBLIC ACCEPTANCE MAKE

TIMKEN

TRADE MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS

YOUR NO. 1 BEARING VALUE

Men in the News

Sahlin Engineering Co., Inc.—Richard H. Melvin has been appointed sales manager.

Dodge Div., Chrysler Corp.—**Robert H. Fischer** has been named new car sales manager; **George H. Stover,** manufacturing manager for car operations; **Robert L. Jenkins,** general superintendent of car manufacturing; **Richard A. Vining,** engineering manager; and **William C. Cawthon,** works manager of the main plant.

Mercury Div., Ford Motor Co.—**Robert Miller** was appointed production programming manager.

Oster Manufacturing Co. — **Roger Tewksbury** has been named chairman of the board, and **T. S. Bonnema** has been made president and general manager.

Chrysler Corp.—**Leroy B. Bornhauser** has been named general manager of the Axle and Transmission Div.; **Arnold W. Hartig,** a member of the basic manufacturing staff; and **Arthur M. Swigert,** manager of the Detroit Universal Div.

Solar Aircraft Co. — **Walker G. Dollmeyer** was named vice-president of operations.

Goodyear Tire & Rubber Co.—**Merritt W. Wolfe** has been made chief engineer in charge of tube and accessory design; and **Paul Beebe, Sr.,** has been placed in charge of foreign operations compounding.

American Motors Corp.—**Edison W. Allen** has been named assistant comptroller.

Seiberling Rubber Co.—**Earl A. Hensal** was appointed production vice-president.

LaSalle Steel Co.—**Thomas A. Kelly** has been elected executive vice-president.

Perfection Steel Body Co.—**R. N. Rick** has become advertising and sales promotion manager.

United Metal Craft Co. — **J. M. Kaelin** is now general manager.

B. F. Goodrich, Canada, Ltd.—**William B. Flora** has been appointed vice-president of sales.

Modine Manufacturing Co. — **Cary C. Wilson** has been appointed general sales manager.

Ohio Seamless Tube Div., Copperweld Steel Co.—**Julius H. Clabaugh** has been promoted to assistant manager of operations; **Donald R. Chew,** head of quality control; **Francis S. Coleman,** chief engineer; and **George P. Jones,** assistant chief engineer.

Yale Materials Handling Div., Yale & Towne Manufacturing Co.—**Fred E. Rau** has been named manager of hoisting equipment sales, and **William B. Bond** and **John H. Eichert** have been made assistant hoist sales managers.

Modern Industrial Engineering Co.—Aaron E. Wilcox has been appointed master mechanic.

L.O.F. Glass Fibers Co., Automotive Research & Development Div.—**George J. Hannes** has been promoted to manager.

Westinghouse Electric Corp.—**B. M. Brown** has been appointed manager of the Baltimore, Md., divisions.

Lindberg Industrial Corp. — **John Wallerius** has been appointed chief engineer.

Gabriel Co.—**Thomas J. Riggs, Jr.,** has been elected executive vice-president and general manager.

Rheem Manufacturing Co.—**I. G. Davis, Jr.,** has been appointed director of planning.

H. W. Loud Machine Works, Inc.—**E. A. Williams** has been appointed vice-president and general manager.

Fenwal, Inc.—**Allan S. Robertson** has been appointed vice-president in charge of sales.

Formsprag Co. — W. Edgar Mulholland has been named executive sales engineer and special representative to the automotive industries.

Cross Co. — Chester S. Johns has been named sales manager for standard machines and products.

Pastushin Industries, Inc.—**Kenneth C. Walkey** has been appointed vice-president and general manager.

General Electric Co. — **Robert O. Fehr** has been made manager of the Mechanical Engineering Laboratory.

Northrop Aircraft, Inc.—**Harold E. Herdrich** was chosen director of master planning.

(*Turn to page* 170, *please*)

Necrology

Ancil H. Bishop, 65, vice-president of U. S. Industries, Inc., died July 30, at New York, N. Y.

Roy Garrison, 51, manager of production and stamping control for the Metal Stamping Div. of Ford Motor Co., died July 30, at Detroit, Mich.

Allan P. Hascall, 65, former director of purchasing for Chrysler Corp., died July 26, at Birmingham, Mich.

Harlan S. Fullenwider, 47, supervisor of standards for the Chevrolet Buffalo Forge and Foundry Plant, drowned July 22 in the Niagara River.

E. Cornell Wallbridge, 55, general manager of distributor sales for Libby-Owens-Ford Glass Co., died July 23, at Toledo, O.

Joseph K. Bole, Jr., 50, assistant sales manager for the Bolt and Nut Div. of Republic Steel Co., died July 19, at Cleveland, O.

Gordon Janes, chairman of the board of Canadian SKF Co., Ltd., died July 21, at Toronto, Ont.

Walter L. Faust, 60, former vice-president and director of Socony Mobil Oil Co., Inc., died July 20, at Daytona Beach, Fla.

Cleveland-equipped 30-ton traveling hoist in plant of the builder, S. Morgan Smith Co., York, Pa.

30-ton traveling hoist operated by 3 CLEVELANDS

TO ensure precision control of the hoisting drums of this traveling hoist, the builder installed a team of Cleveland Worm Gear Speed Reducers. Double reduction of motor speed is effected through an efficient hookup. Gear shaft of the smaller center unit is extended on each side and connected with the input axles of two larger units which operate the hoisting drums at desired low speeds.

Clevelands fit perfectly into complex power transmission jobs. They're compact—right angle construction of a worm gear drive saves space. High shock load resistance and efficient performance are inherent. Parts are reduced to a minimum, reducing maintenance. Torque flow is smooth and uninterrupted. The case-hardened steel worm and nickel-bronze gear actually improve with use.

Wherever you have a power transmission need or problem, simple or complex, find out how a Cleveland speed reducer can handle it dependably and economically. Send for Catalog 400 today. The Cleveland Worm & Gear Company, 3274 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited

CLEVELAND
Worm Gear
Speed Reducers

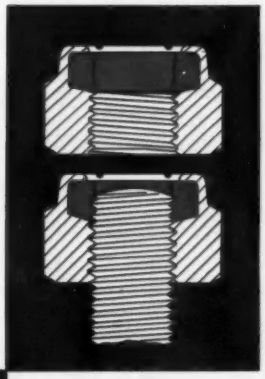
What's special about this STOP NUT?

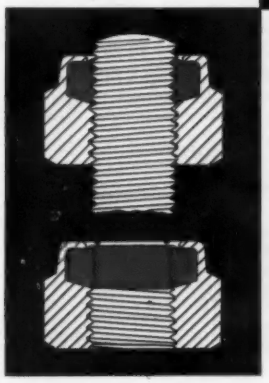
Several things make this nut unusual. For instance, you can "stop" it at any position on the threaded length of the bolt . . . or wrench it tight against the work where it protects bolt threads against corrosion and prevents liquid leakage. No matter where you leave it on the bolt, it will remain tight in that exact position, even though you subject it to heavy vibration and shock loads. But use a wrench on it and it comes off as easily as it went on. The red locking collar is nondestructive—does not gall bolt threads or remove plating. You can remove it and re-use it again and again.

What gives it its grip?

1 The locking collar is unthreaded and elastic. It has an inside diameter smaller than the major diameter of standard bolts.

2 The bolt impresses a mating thread into the collar and the resulting compressive forces exert a constant friction grip on the bolt. . . .





3 and exert a downward thrust bringing the lower flanks of the bolt thread into firm metal to metal contact with the matching nut threads, eliminating normal axial play.

4 Nut is removable and reusable . . . the Red Elastic Collar retains its grip after repeated usage.

Will it hold under ALL conditions?

The locking principle of the Elastic Stop® nut has been tested and proved by over 25 years of actual field service. Elastic Stop nuts are used on locomotives . . . and pile drivers. They fasten hedge shears and harvesters, drilling rigs and washing machines, trucks and roller skates. And no Elastic Stop nut customer has ever stopped using them because of unsatisfactory performance.

What about sizes and materials?

Elastic Stop nuts are available from a watchmaker's 0-80 all the way to 4"—in materials that include stainless steel, brass, aluminum and other alloys. Protect your product with "fastener insurance." Try Elastic Stop nuts on trouble spots, whether to protect expensive heavy equipment from costly downtime or to guarantee the accuracy of delicate electrical equipment by maintaining precision adjustments. We'll supply free test samples.

ESNA®
TRADE MARK

ELASTIC STOP NUT CORPORATION OF AMERICA

Dept. N82-85, 2330 Vauxhall Road, Union, N. J.

Please send the following free fastening information:

☐ ELASTIC STOP nut bulletin

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name_____ Title_____

Firm_____

Street_____

City_____ Zone_____ State_____

60 second tour

shows it in a nutshell . . .

All-Inclusive Spring Service

COMPRESSION SPRINGS
Regular, Double

COMPRESSION SPRINGS
Special Shapes
Variable pitch

VOLUTE SPRINGS
Coned end

EXTENSION SPRINGS
Special Hooks
and Loops

EXTENSION SPRINGS
Swivel End
Drawbar

TORSION SPRINGS
Single, double
Edge wound

POWER SPRINGS
Clock or Motor

FLAT SPRINGS
Arched, Curved-beam
Elliptical

CLIPS, CLAMPS
and COLLARS

FASTENERS and
RETAINERS

HAIRSPRINGS
for Instruments
Gauges, etc.

SPRING WASHERS
Wavy, Star, Finger,
Expander, etc.

BELLEVILLE SPRINGS
In Series, Parallel
Parallel-series

DIAPHRAGMS
Discs, Plates

PLUS
COLD-ROLLED
SPRING STEEL

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TRACK WHEEL BEARINGS ARE COMPLETELY PROTECTED

Whether it's tropical muck or crystal sharp Alcan dust, nothing sneaks past the C/R End Face Seals guarding the track wheels of this giant Oliver OC-18 Crawler. And here's why: The mating rings in this steel-on-steel C/R Seal are lapped flat within .000034 inch! They form a leakproof seal so dependable that even under the worst field conditions the oil and the bearings stay clean and the oil level does not require the usual frequent checking. Seal performance like this cuts downtime for lube checks . . . saves big money on round-the-clock operations. You can have equally dependable performance . . . and savings . . . with C/R Oil Seals.

C/R engineers will cooperate with you on special designs, or help select the right stock seal for a wide range of applications. Write for detailed information.

More automobiles, farm and industrial tractors rely on C/R Oil Seals than on any similar sealing device.

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Offices in 55 principal cities. See your telephone book.

In Canada: Manufactured and Distributed by Super Oil Seal Co., Ltd., Hamilton, Ontario

Export Sales: Geon International Corp., Great Neck, New York

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Sirvene (synthetic rubber) molded pliable parts • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

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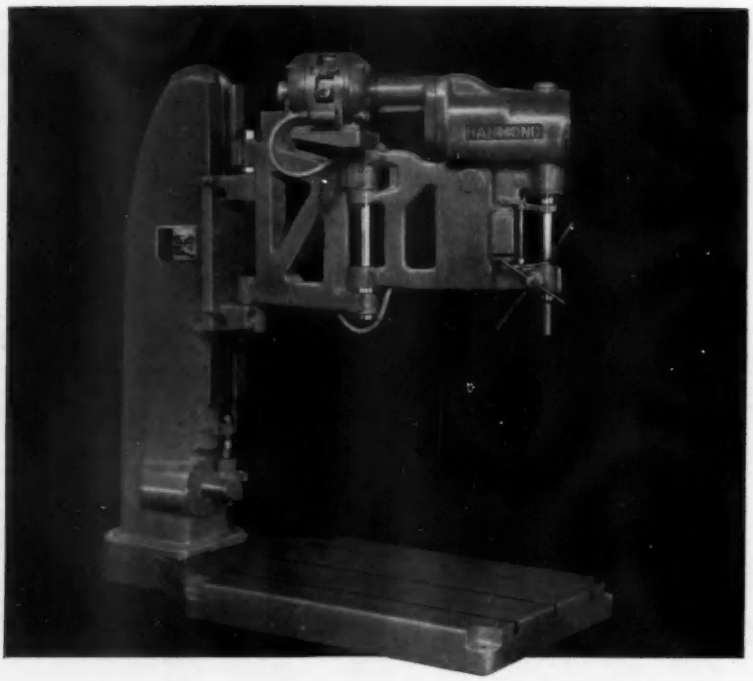
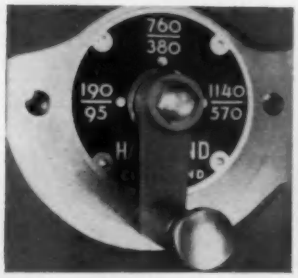
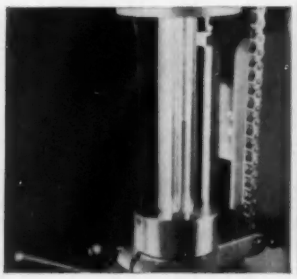


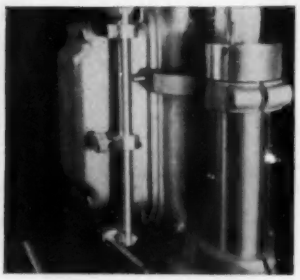
for *faster* radial drilling and tapping

■ Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY • **Cleveland 8, Ohio** • Detroit Office: General Motors Building



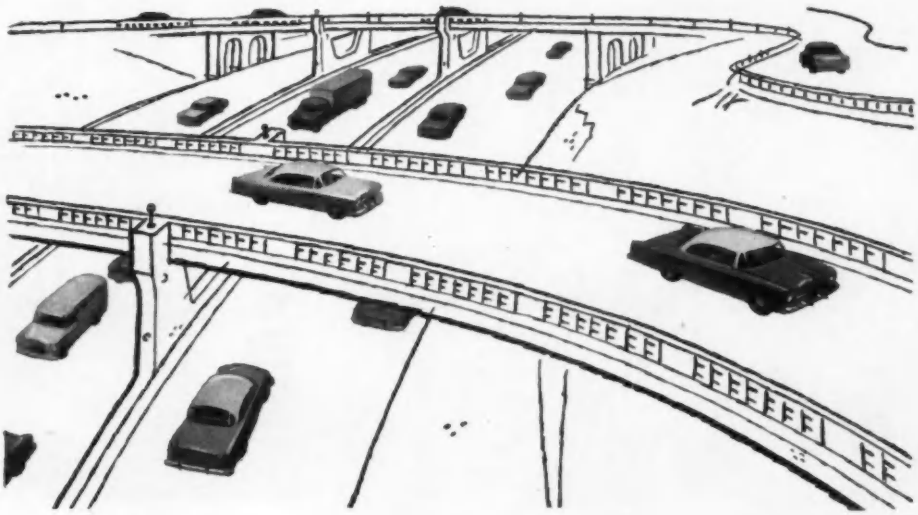




Engineered for production

FOOTBURT

MACHINE TOOLS



Every day, **EVANITE** separators are proving their advantages in day-to-day use!

Every day Evanite battery separators are proving their worth in severe, on-the-road service under all weather conditions. And every day these tough, durable separators are helping deliver the high performance demanded of batteries used in today's modern cars.

Here's what you get when your battery manufacturer specifies Evanite – high uniform porosity, extremely high acid resistance, superior wettability, superior permeability, low web thickness, outstanding mechanical strength within the battery, resistance to abrasion and oxidation. You get all these, *plus!* Because Evanite undergoes controlled swelling after insertion in the battery, resulting in a tight-fitting element that resists the effects of road vibration.

Ask your battery maker to investigate Evanite today. Urge him to write Evans Products Company, Dept. P-8, Plymouth, Mich.

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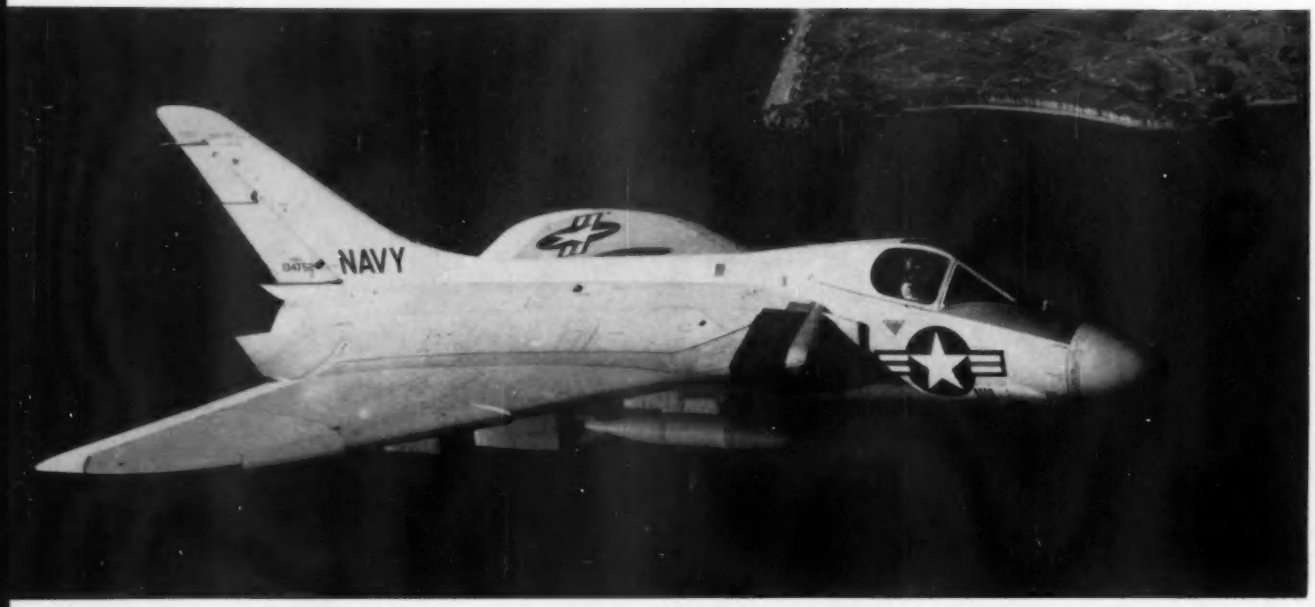
EVANS PRODUCTS COMPANY also produces: truck and bus heaters; Evaneer fir plywood; railroad loading equipment; Evans bicycles and velocipedes



New Final Assembly Methods Used to Build F4D-1 DELTA TYPE FIGHTER

By C. H. Smartt
F4D Project Superintendent
TORRANCE FACILITY, DOUGLAS EL SEGUNDO DIVISION

A NEW concept in aircraft production methods for final assembly was inaugurated for the Navy's supersonic F4D-1 Skyray produced at the Torrance facility of Douglas Aircraft's El Segundo Division. It consists of two stationary platforms on which the airplanes are assembled on movable fixtures. Each of these 700 ft long platforms is elevated 100 in. off the floor, permitting installations and testing on the underside of the airplane simultaneously with work on the topside.

There was a good reason for this departure from the generally accepted method of final assembly on movable dollies on the floor. An ordinary airplane has the conventional wing, fuselage and tail. Being no ordinary airplane, but a modified delta type with a fuselage consisting only of a nose section, the Skyray required a production flow of a different nature.

Fourteen major sub-assemblies make up the structure of the Skyray. They include the fuselage nose, the ducts, the pilot's enclosure, the center wings and outer wings, the upper and lower rudders, the stabilizer, the dorsal fin and panel and tail cone, along with other smaller assemblies.

Conventional jigs are used for these various subassemblies and the completed units flow to assembly areas such as Figs. 1 and 2. In these remote assembly areas where the units are of fairly easy access, the mechanical, electrical and hydraulic lines are installed and given preliminary functional tests far from the crowded main assembly lines of old.

Next the main structures flow to the joining line where, at three positions, the airplane takes shape, Fig. 3. The nose section accepts the two inner wing sections and the whole is capped by the dorsal panel, thus forming what would normally be the fuselage.

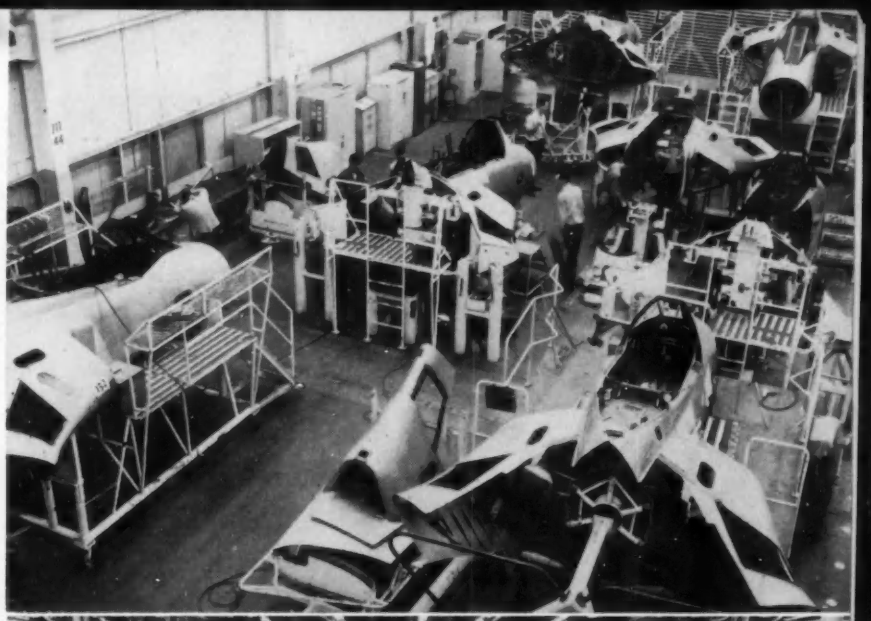


FIG. 1—Fuselage nose and induction scoops are joined to make a major sub-assembly. All wiring for the pilot's cockpit and the radio compartment is installed at this point. Jig-mounting is such that all areas can be reached easily.

Six assembly positions, called inner wing installations, follow on the floor where small assemblies are installed. All wiring and lines are spliced and connected to those previously installed in the nose section. Substantially all small installations, including all systems, are completed in this area, Fig. 4.

To complete the structure, two mating jigs are utilized where the vertical stabilizer, with the installations previously completed, and the tail cone are connected to the wings and dorsal panel.

The airplane is then ready for raising to the first half of the elevated assembly line

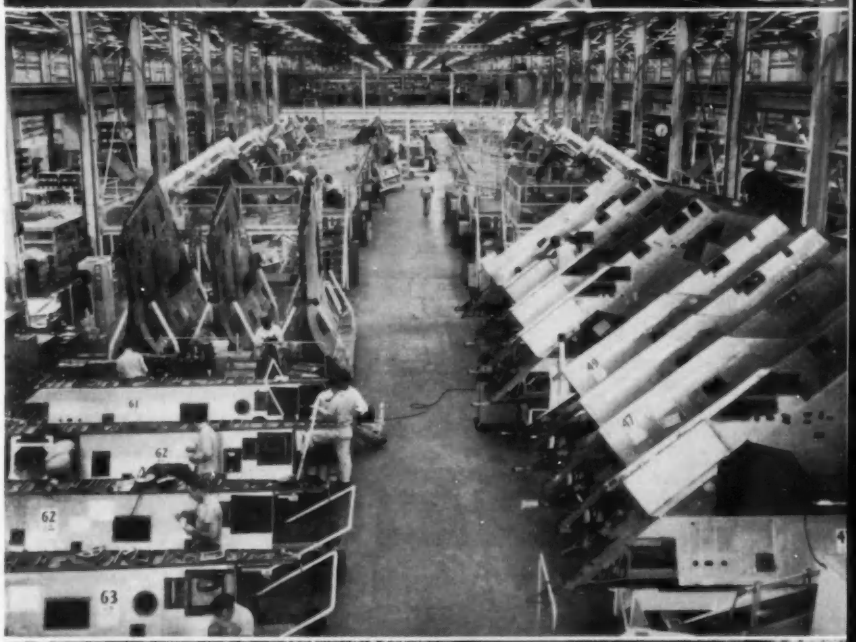


FIG. 2—Center wing sections are formed by joining the box section on the left to the stubs on the right. They are mounted on jigs for easy accessibility during construction. Two of these center wing sections will form the thin, swept, low-aspect-ratio wing.

where it is cradled on simple fixtures of two small roller assemblies that are bolted to the bomb racks.

The first half of this two-bay assembly line of 17 stations each is used to install such major components as the outer wings complete with slats, elevons, wing-tips, upper and lower rudders, inner elevons on the stub wings, tank units at the inner portion of the stub wings, and the main and nose landing gear.

This line is unique in that both elevated platforms are intercepted at their halfway points by the main plant aisle, 18 ft wide. When line-move time arrives, signaled by bells and blinker lights, two rail bridges are swung across the aisle and

FIG. 3—The nose section with induction scoops is joined to the two center wing sections which have been capped by a dorsal panel.

FIG. 4—On the mating jig, the vertical stabilizer and fixed tail cone are installed. All hydraulic, electrical, and mechanical hookups are accomplished in this position.

secured, and the movable fixture carrying the airplane rolls across. The bridge rails are then swung out of position and secured to the sides of the platform. As these two bays are parallel, the airplanes must be swung around the corner as shown in Fig. 5. This is done with an overhead crane and slings.

The first few positions of the last half of this assembly line are used to complete any unfinished work that might have been unavoidable at previous stations, and late mandatory engineering changes.

Then comes inspection. On the last 12 stations of this 17-station installation line, com-

FIG. 5—Airplane is lifted into the first position on the line.

pany visual inspection takes place prior to final company and Navy operations. This includes operating all systems by attaching power and hydraulic sources to the airplane. All movement is initiated from the cockpit. Passed by the company and Navy inspectors, the airplane is lowered to the floor at the end of the line platform where the armament station is located. At this point the guns are boresighted and fired, using dummy ammunition to check for proper operation.

The airplane is ready then to be mounted on a specially designed Douglas trailer for transportation to the hangar at Los Angeles' International Airport for installation of its J-57 engine, its radar and its armament.

The line itself is worthy of note. The basic ideas of the ele-

FIG. 6—Airframe is moved by a crane from one bay to the other on interlocking rails.

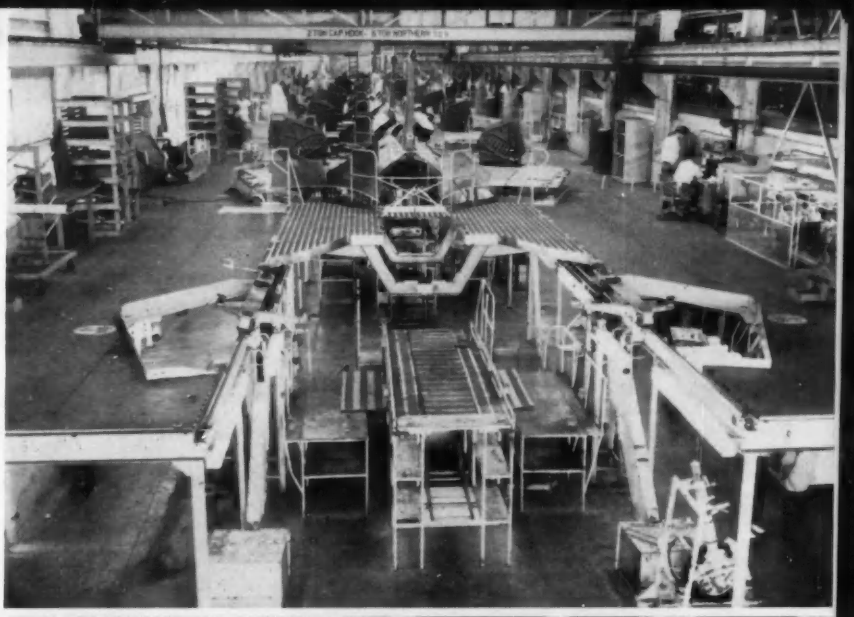


FIG. 7—Typical holding provisions for the elevated line are shown in the first station which is ready to receive the airplane.

vated lines were drawn up by the Torrance Tooling Departments which worked closely with the Manufacturing Departments. The project was coordinated by E. W. Hamilton, chief tool engineer at Torrance, and E. W. Kinyon. F. G. Lea did most of the layout work.

An elevated position for the line was selected because it eliminates dollies and their accompanying 10 or 12 workstands. Workstands under the line have been reduced to four and are attached to the floor in their proper work positions. Topside, there is a cage station that runs on the craneways, for work on the stabilizer.

The line's elevated position

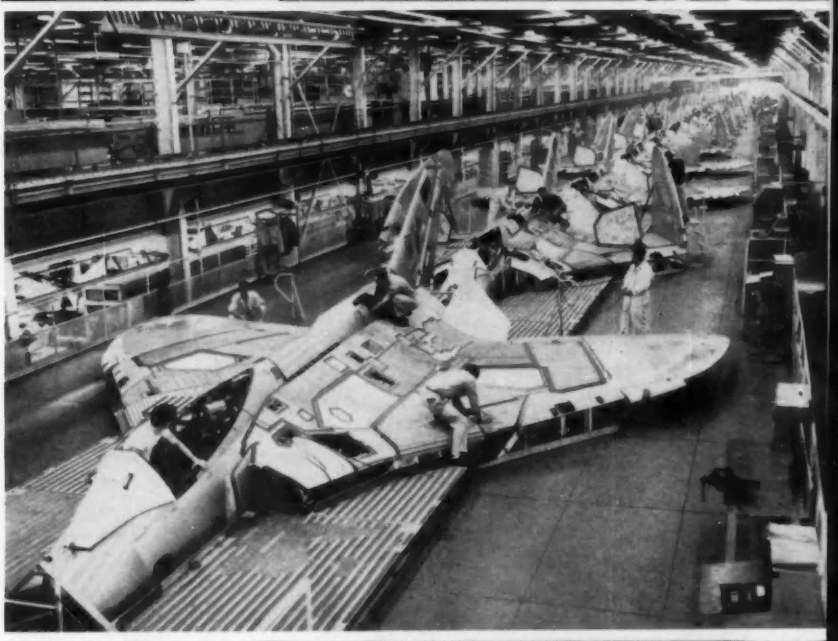


FIG. 8—Preliminary operational checks on electrical, hydraulic, and mechanical components are made in this section of the line. Rudders, outer wings, elevons, cockpit equipment, fuel cells, and landing gear are installed.

is such that standard storage racks can be placed at points of need on both the floor and the stationary platform. All necessary parts are stored adjacent to their installation point.

The basic frame of the stationary line was made of I-beams and pre-fabricated steel sections, and bolted in the line. It was determined by the tooling department that it was more economical to bolt the sections rather than to weld them together. This provided sufficient strength and rigidity. Each section, which is 41 ft long and has 12-ft platforms on each side, covers the configuration of the airplane.

The middle 15 ft of each section forms a cradle that supports the airplane and moves on rollers down parallel tracks.

(Continued on next page)

FIG. 9—Work on the underside of the line progresses simultaneously with topside work.

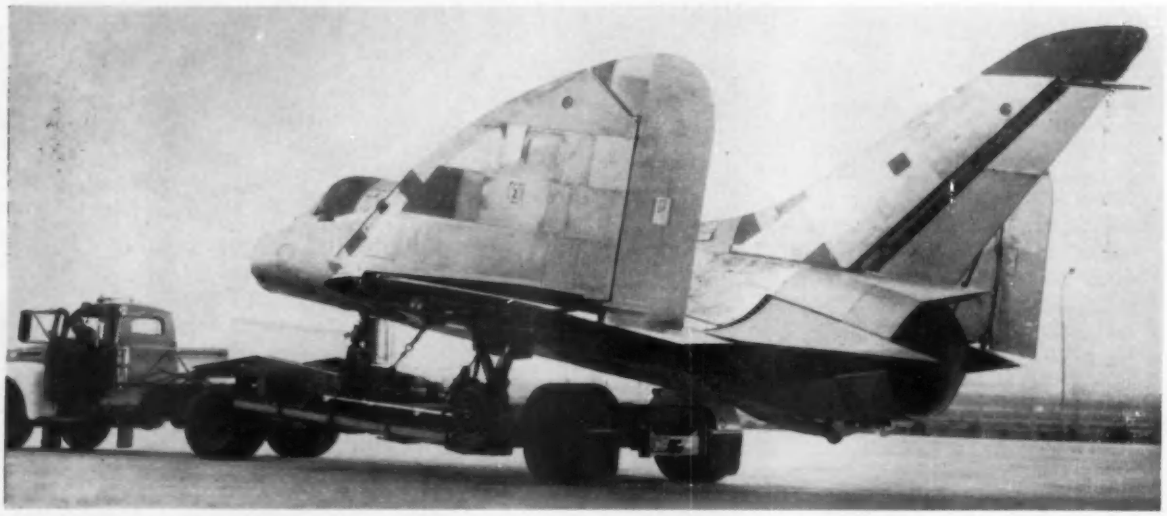


FIG. 10—When the airframe leaves the final station, it is taken at night on a Douglas designed and built trailer to the hangar location at International Airport.

The rails are made of formed sheet stock, thus eliminating any tendency of the rollers to slip from the rails.

The cradle has light weight and great strength, for it is constructed from an aluminum sandwich that uses Douglas Aircomb panels. This Aircomb material is a proprietary product of Douglas (honeycombed paper-plastic treated).

The decking of the stationary platform is formed steel over which ½-in. Masonite and plywood are secured. The overall depth of the decking is two inches. Only six supports were needed with this construction in the overall 41-ft length of each section, thus cutting to a minimum the structural members for the platform.

Safety is paramount in a line movement such as this and it was given complete consideration. That there have been no accidents chargeable to the line is an indication of the care given the installation.

When the line is ready for movement, the pulsating bell begins ringing and continues ringing until the move is complete. At each of the positions there is a release switch and all must be engaged before the line can move.

Motive power is from two 3-hp motors in each section that can be run individually or hooked in series. Maintenance of the line is negligible, being far less than on a continuously operating line.

The decentralization of sub-assembly operations in the Torrance facility has numerous advantages over typically crowded main assembly lines. The installation of parts by the department that fabricates them at their own location eliminates much transportation and paper work. Responsibility for completed parts builds group morale and avoids conflict. The final assembly is clean and uncrowded.

• • •

American Motors Develops New Aircooled V-4 Engine

The Special Products Div. of American Motors Corp. has developed a new lightweight, aircooled, 62 hp, V-4 engine designed for a number of applications. While the engine does not appear applicable to large automobiles because of its low horsepower, it could be used in smaller passenger or commercial vehicles and in certain types of military vehicles, particularly lightweight units which have been designed to be transported quickly to combat areas by aircraft. The engine reportedly is being considered by both Army Ordnance and the Marine Corps.

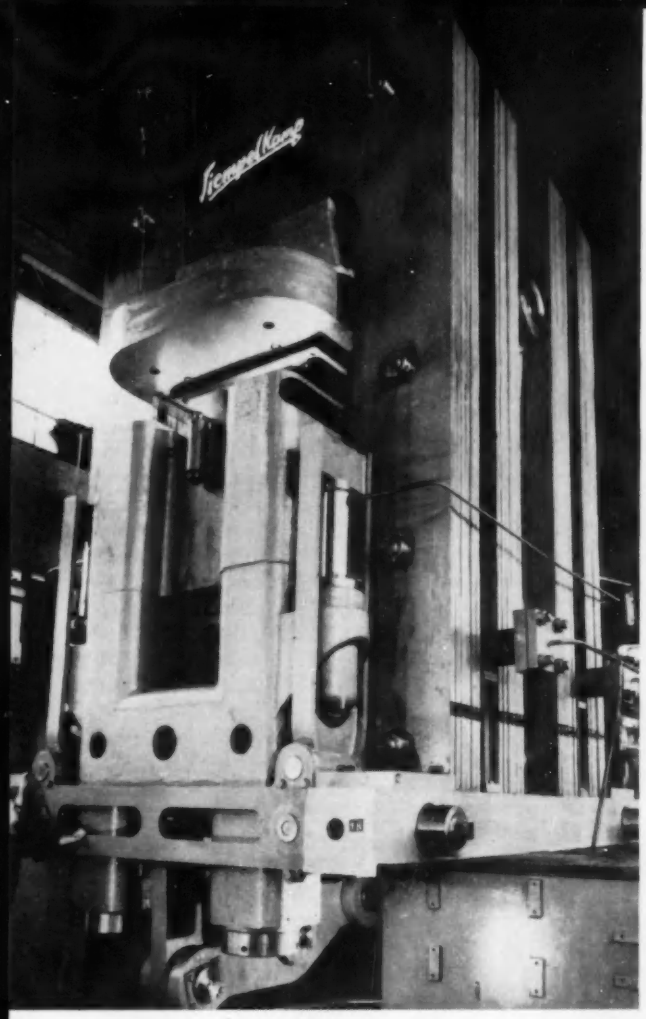
Other possible uses for the engine might include powering small passenger automobiles, such as the Metropolitan, which currently has a 52-hp four-cylinder engine, and for such stationary equipment as pumps and generators.

V-4 engines are not new to the automobile industry. The first one, a 20-hp, four-cycle, aircooled power plant, was introduced on a 1903 Marmon and used by that company for a number of years.

The AMC engine has aluminum diecast cylinders and crankcase, and bores have been chrome-plated. Various other components, such as cylinder heads, covers, and timing gear housings also have been designed for diecasting. Weighing 200 lb, the valve-in-head engine has a 108 cu in. displacement and compression ratio of 7.5 to 1. It has a bore and stroke of 3.25 in. by 3.25 in.

Mack Awarded $11 Million For 10-Ton Army Vehicles

An $11.78 million contract for production of 10-ton trucks for the Army has been awarded to Mack Trucks, Inc., by the Detroit Ordnance Tank-Automotive Command. Delivery of the units, which will be produced in Allentown, Pa., is scheduled to start in October and run through May, 1957. The contract calls for six-wheel-drive truck tractors, cargo carriers, and truck chassis.



Press as assembled in Germany before being dismantled and shipped to Canada.

Huge Rubber Pad Forming Press Goes Into Operation in Canada

By James Montagnes

THE largest hydraulic rubber pad forming press in existence went into operation at Avro Aircraft Ltd., Toronto, late in July, for use in forming parts for the new Avro CF-105 supersonic delta-wing, twin-jet fighter for the Royal Canadian Air Force.

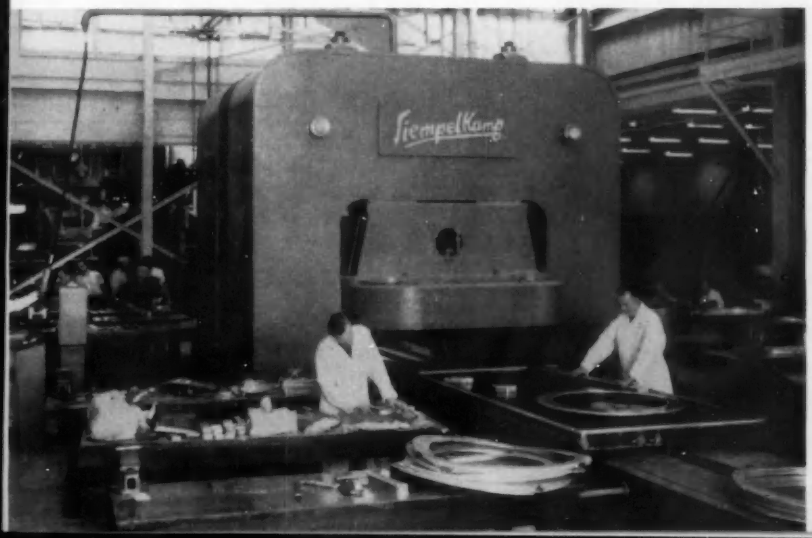
Two years were required to design, manufacture and install the assembly. It was designed and built for Avro Aircraft by Siempelkamp Co. of West Germany. The installation required 600 tons of components and auxiliary equipment to produce an operating pressure of 15,000 tons. It can complete a cycle of operation in one minute.

A feature of the new press is that the total pressure is exerted from below, forcing the loading table up into the rubber pad. The frame is made up of metal "wafers" in groups of six. Each wafer weighs 10 tons. About 20 ft of the press is below floor level and the foundations go down 38 ft. The pad, measuring 10 ft by 5 ft, weighs 3686 lb and was manufactured by Goodyear Tire and Rubber Co. of Canada.

The main cylinder operates vertically. The fast advance stroke is made by a 500-ton cylinder in the center of the press. A big oil tank under a continuous 30-psi pressure supplies fluid for the fast advance speed. Four pullback cylinders located on the side of the main cylinder make the fast return stroke. A hydraulic equalizing device allows any eccentric load on the loading table even under the maximum pressure.

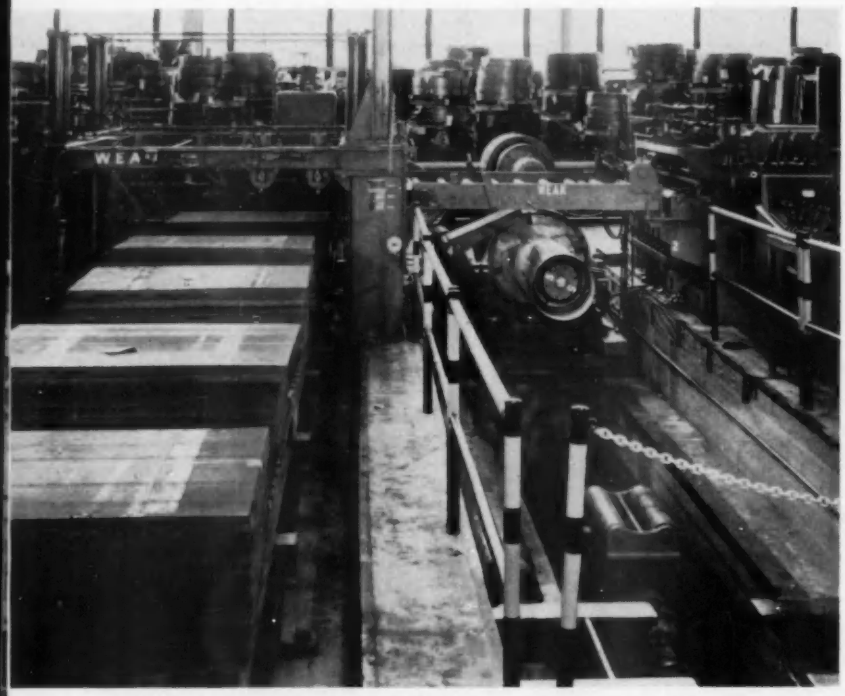
Two loading tables, one on each side of the press, are hydraulically operated with high speed and cushion slow-down for both directions. It is the first press which has a hydraulically operated packing-change device. All important guides and bearings are connected to a pressure greasing system.

Stroke is 19 in. and oil pressure is 5700 psi. Size of the rubber pad is 10 ft by 5 ft by 1 ft in thickness. Pressure on the pad is 4000 psi.



Loading forms and metal sheets on one of the two work tables on each side of the press. Operator at left presses a button which slides the table under the press. He touches another button and the loaded table is forced up into a rubber pad under 15,000 tons pressure.

Shot Blasting Hot Rolled Steel

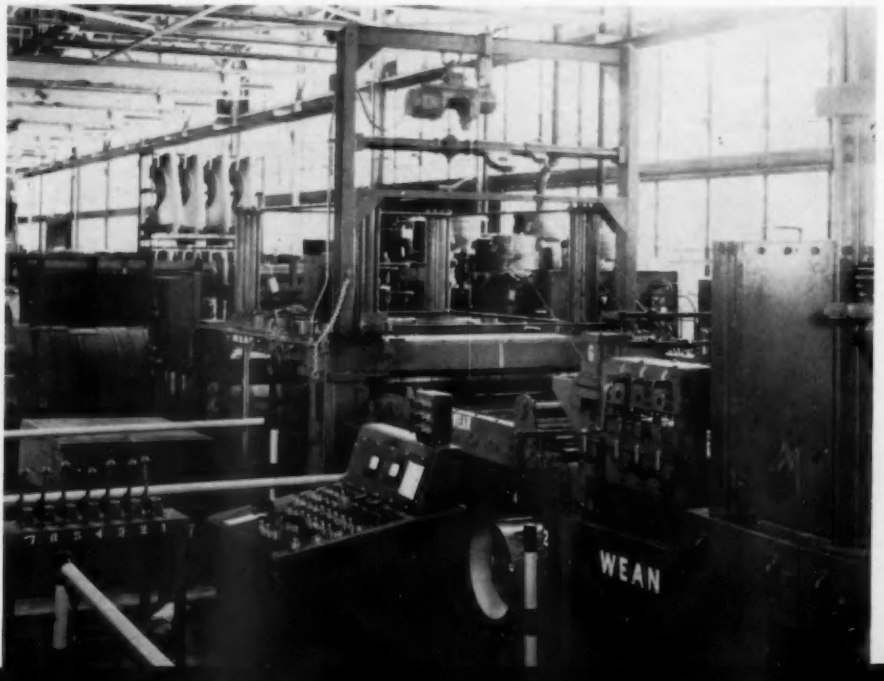


A pack conveyor is used at the entry end of the Rotoblast machine when sheet stock is used. This conveyor carries the stock to a hydraulic lift, which raises the steel to magnetized rollers that move the strip over the cross-over conveyor into the straightening rolls. When coil stock is run through the descaler, the cross-over conveyor is raised by electrical hoist. The coil stock is carried to the uncoiler spindle by means of the entry coil car (in pit).

OLDSMOBILE recently installed a Pangborn Rotoblast descaling machine, together with loading, straightening, feeding, oiling, and recoiling equipment to prepare heavy gage strip and coil stock for the press shop for a variety of chassis parts that do not require a cold finished surface. This new technique was adopted primarily for economic reasons.

Descaling by shot blasting makes it perfectly feasible to purchase hot rolled steel without paying for the extra cost of pickling and oiling. At the present writing Oldsmobile is descaling stock for producing lower control arms, rear axle housing sections, rear axle housing covers, and fluid coupling torus covers. It is quite likely that the list of applications will be expanded considerably for 1957 cars. Fortunately, the productivity of this

By Joseph Geschelin



The Pangborn Rotoblast is completely automatic in cycle and is controlled from a push-button panel. Controls at the entry end of the machine operate the loading conveyors for both strip and coil stock, hydraulic and electrical hoists, cross-over conveyor and other Wean equipment.

for Automobile Components

fully automatic equipment is capable of handling all of the company's requirements with the one unit.

The equipment is arranged to handle material in a range from 1/16 in. to 0.250 in. thick, ranging in width from 30 to 60 in. Coiled stock is handled in 30,000 lb rolls. Equipped with variable speed control, the machine can be adjusted to take care of speeds ranging from 60 to 160 lineal fpm.

The descaling unit—as installed—is capable of handling both strip and coiled stock. To this end, there are two separate conveyors at the loading and exit ends of the machine—the outer ones for strip, the inner for coils. The accessory equipment for loading, straightening, and feeding at the loading end, and oiling and recoiling equipment at the exit end was all supplied by Wean.

When running strip through the descaler, the material is fed to the machine on the cross-over conveyor and the top strip on the pile is picked off automatically by means of magnetized rollers. This moves the strip into the straightening rolls, thence directly into the descaler. At the exit end the stock—whether it is strip or coil—goes through an oiler which applies a special compound, doubling as a drawing compound as well as a rust preservative.

When coils are put through the descaler, they come in on the inner conveyor at the loading end, the coil being pushed into position to slide directly onto the big mandrel. The end of the coil is then engaged with the straightening rolls and proceeds automatically through the descaler as in the case of strip.

One of the problems concerned with using coiled stock is the matter of recoiling with an even edge on both sides. To gain proper control, the Oldsmobile installation includes an Askania "true-position" control unit. It maintains contact with an edge of the stock as it moves to the recoiler and constantly compensates for variations in alignment by shifting the stock to one side or the other to maintain even coiling.

The Pangborn machine is completely automatic in cycle and is controlled from a push-button panel. Among other things, the panel contains an ammeter for each abrasive wheel, the calibration indicating the rate of abrasive flow to each wheel. The Rotoblast units are arranged in pairs, above and below the strip, to descale the top and bottom surfaces simultaneously. The Oldsmobile installation employs the S-110 True-Steel shot for descaling.

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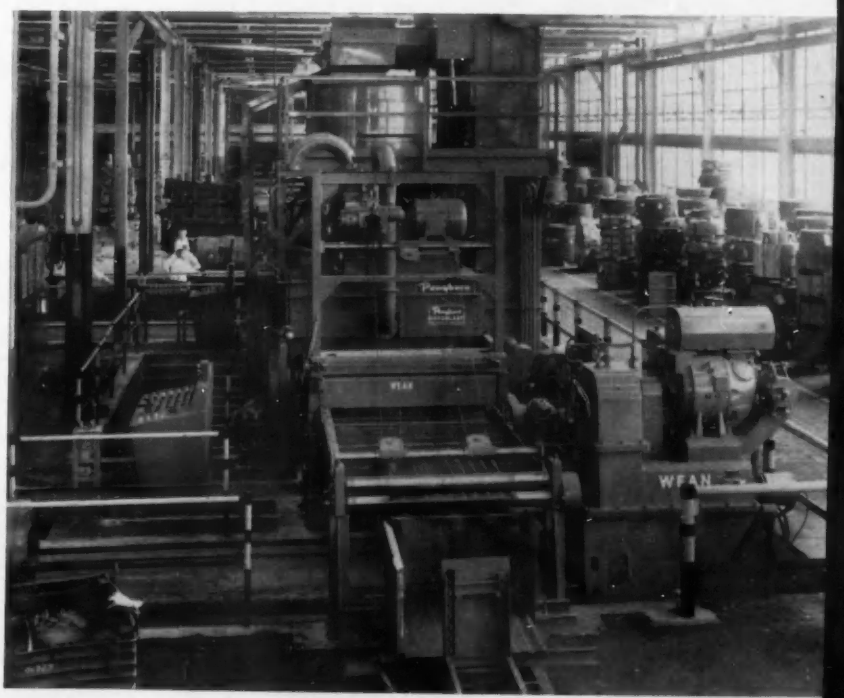


A view of the exit end of the Rotoblast machine shows the general plan of the unit plus the oiling machine, cross-over conveyor, uncoiler for coil stock and the exit operator electrical control panel. When sheet stock is run through the descaler, it is carried through the oiling machine, over the cross-over conveyor and stacked in the piler. When coil stock is used, the cross-over conveyor is raised and the descaled steel is threaded on the recoiling spindle.

How to Choose PLASTIC DIES

By W. J. Esdale
Manager, Allite Division
ALLIED PRODUCTS CORP.

SOME users are so enthusiastic about plastic dies that they occasionally employ them when they should not. Others condemn them because of one unsatisfactory experience. Somewhere between these two extremes lies the right approach to plastic dies.

We have heard of plastic dies striking off up to 80,000 pieces. However, these dies were built with so many metallic inserts that one could no longer think of them as being "plastic" dies. It should be recognized, therefore, that longer wear can be had from a steel or iron die than from an all-plastic or a plastic-faced die. For this reason, when only straight machining on a planer or milling machine is required to fashion a die including its binder-line, conventional materials such as iron or steel should be used. However, where irregular surfaces or contours must be duplicated in the die, the punch, and the binder line, the new plastics for tool making should be investigated. Use of these materials often eliminates many hours of costly operations.

In making a choice between metal and plastic dies, these questions should be considered carefully:

(a) How many pieces are to be formed?

(b) How much work (change or shape) is the die to accomplish? What are the tolerances?

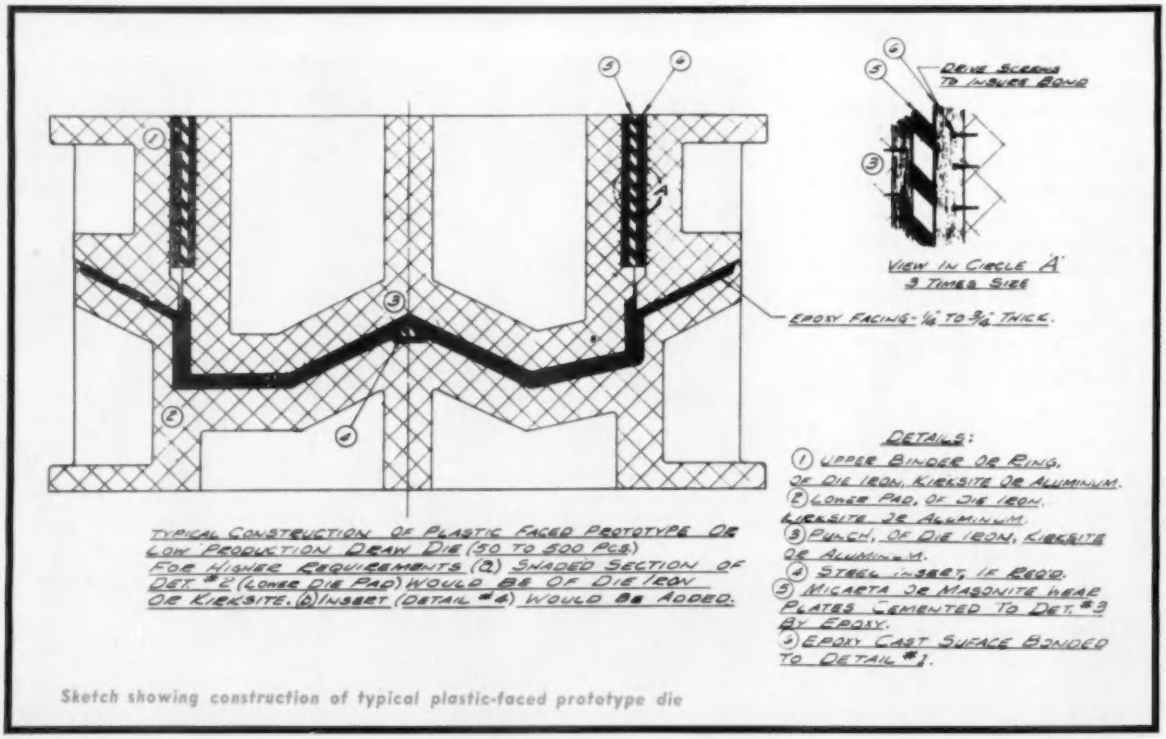
(c) What is the end product? Is good appearance essential?

(d) Does the design of the stamping readily lend itself to the use of plastic for building the die?

(e) Would the severity of the drawing operation require multiple metal inserts in the ring, the pad, or the punch?

(f) Extremely important—how soon is the first piece needed? How many others are needed and how soon thereafter?

(g) Do you have machining capacity and enough skilled craftsmen familiar with fitting and barbering metal, or must you use some easier method of die construction to get acceptable stampings?


DRIVE SCREWS TO INSURE BOND
VIEW IN CIRCLE 'A' 3 TIMES SIZE
EPOXY FACING: 1/4 TO 3/4 THICK.
DETAILS:
(1) UPPER BINDER OR RING, OF DIE IRON, KIRKSITE OR ALUMINUM.
(2) LOWER PAD, OF DIE IRON, KIRKSITE OR ALUMINUM.
(3) PUNCH, OF DIE IRON, KIRKSITE OR ALUMINUM.
(4) STEEL INSERT, IF REQD.
(5) MICARTA OR MASONITE WEAR PLATES CEMENTED TO DET. #3 BY EPOXY.
(6) EPOXY CAST SURFACE BONDED TO DETAIL #1.
TYPICAL CONSTRUCTION OF PLASTIC FACED PROTOTYPE OR LOW PRODUCTION DRAW DIE (50 TO 500 PCS.) FOR HIGHER REQUIREMENTS (2) SHADED SECTION OF DET. #2 (LOWER DIE PAD) WOULD BE OF DIE IRON OR KIRKSITE. (6) INSERT (DETAIL #4) WOULD BE ADDED.

Sketch showing construction of typical plastic-faced prototype die

(h) How much capital is now available for the die construction program?

Many of these points are self-explanatory. Others, however, such as quantity, for instance, need additional clarification. How many pieces are required to make a plastic die practical? Obviously, this depends on the size and shape of the part, but for many of the prototype automobile components we stamp out, the break-even point, comparing hand-shaped parts with those stamped from plastic dies, is somewhere between 25 and 100 parts.

For example, modern automobile body panels have highly complicated, three-dimensional curves and contours, which are well adapted to plastic tooling for prototype work In preparing the first few fenders of a new model, the manufacturer usually builds a hardwood hammer form to the shape of the fender, including steel edging and inserts, to achieve the necessary flange conditions. Highly skilled artisans then fashion individual fenders into shape from a flat sheet of steel. When secondary work—flanging, trimming, piercing and metal finishing—is included, approximately 100 to 150 man-hours are required to produce each fender. Obviously, the unit cost per fender is high, and if enough of these fenders are needed, a plastic prototype die soon pays for itself.

Another point in favor of plastic dies is that of short delivery time. In a normal fender development program, two finished sets of fenders could be produced from the plastic prototype die and passed through the secondary operations in about 12 weeks. At this rate, 20 to 30 sets of fenders could be made available at the end of 16 weeks. On the other hand, if hand hammer forms were used, the same thirty fenders might require up to six months to complete. In general, the use of plastic-faced dies may permit time savings of 25 to 50 per cent for automotive prototype tooling, including other automobile body panels such as roofs, hoods, deck lids, doors, quarter panels, floor pans, etc.

In addition, with plastic tools the engineering and

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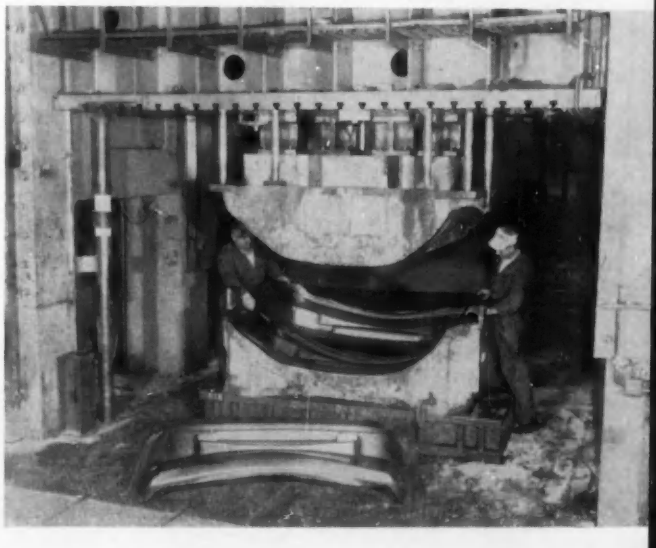


TOP PICTURE

Epon resin formulation is here being applied to a female plaster to produce the die surface coat. Plaster splash is generally taken from the original wooden or clay model, or from a laminated duplicate.

MIDDLE PICTURE

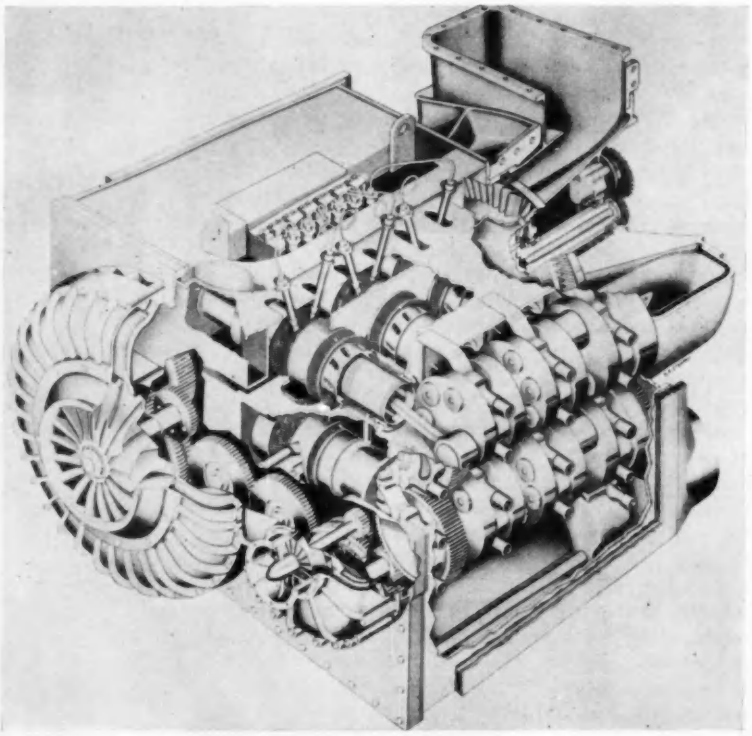
To position metal core of pad ½ in. exactly away from the punch, serving as the model, clay locating ridges are applied across all critical surfaces. Note that die surface coat has already been applied to the punch, but will come off as part of the pad after the epoxy resin cast into the ½-in. space between it and the metal core has cured.

BOTTOM PICTURE

Die try-out. Triple-action press applies 120 tons to the ring, while punch enters cavity under a pressure of 350 tons. A stamped cowl is visible in the foreground.

ORION
A Gas-Generator Turbo Compound Engine

By Ralph J. Hooker
GENERAL
ENGINEERING
LABORATORY
General Electric Co.



Cutaway view of Rigel engine

IN June of 1950, the General Electric Co. started a power plant development program for the U. S. Army Ordnance Corps. The project was named "Orion" after the constellation Orion. This contract was with the Research and Development Branch of the Tank Automotive Center, Detroit Arsenal requiring the development of a turbo-gas generator engine for application to tanks and other track vehicles. The contract was written to cover various phases of the over-all program and each phase was to run consecutively and blend, one into the other. There were four basic phases.

These four phases included analytical cycle studies, single cylinder engine design, construction and test and the design of a full size engine, and running an engine in a tracked vehicle.

This last phase was being actively worked on when orders were received to cancel all outstanding work and complete the project on December 15, 1955.

It was proposed by the General Engineering Laboratory that one of the compound engine designs might attain the dual objectives of greater power density as well as improved efficiency, even to the extent of approaching Diesel engine thermal efficiency. At the conclusion of the study phase, the regenerative cooled cycle was adapted as best fitting all the requirements and the inferred meaning of the specifications. This cycle was essentially as follows: The OP engine drove two air compressors, one for the combustion air which was required to be finely filtered, and a cooling air compressor requiring less filtration. The cooling air compressor operated at approximately the supercharge pressure ratio, and the air was discharged at a corresponding temperature. The idea of the regeneration was that the cooling air would absorb the heat rejected from the cylinder wall and a certain percentage of this heat is converted to work in the turbine. The two air streams, combustion air and cooling air, joined together down stream from the engine at a common pressure and at a mixture temperature consistent with the air flow and fuel setting. The resulting hot gas stream then entered the turbine from which was derived all the useful mechanical power.

In addition, it was felt that the torque-speed characteristics of a turbine would be an advantage, lead-

ing to improved types of transmission. Therefore, the Orion power plant must be considered more in the light of a torque converter rather than as a gas turbine power plant. In the initial stages of this development the specifications were very broad, and this allowed quite a wide variation in interpretation by the engineers of the Research and Tank Automotive Center of the Ordnance Corps.

The specifications were as follows: (Note: HP originally specified was 900 hp. Later decreased to 600 hp.)

1. Turbine shaft horsepower—600.
2. Minimum life—500 hours.
3. Specific fuel consumption—approximately 0.5 lb/hp/hr.
4. Cooling—engine must be air cooled.
5. Fuel—Diesel fuel oil (to include gasoline at later date).
6. Water tightness—fording rivers and submerged operations.
7. The subject power plant was to fit into the existing engine compartment of the M-47 tank.

Rigel Engine

The Rigel engines represented the culmination of the fourth phase of the project. In these engines were assembled the separately developed components which were used to demonstrate and finalize the proposed regenerative cooled gas generator-turbo compound engine. Even though these components, consisting of cylinders, pistons, compressors, turbines, etc., were proven satisfactory on the single cylinder test engines or on the compressor and turbine test stands, there was always present the peculiar matching problems when these components were applied to the multicylinder engine. These problems consisted of maldistribution of air between the two compressors due to cylinder cooling fins or scavenge

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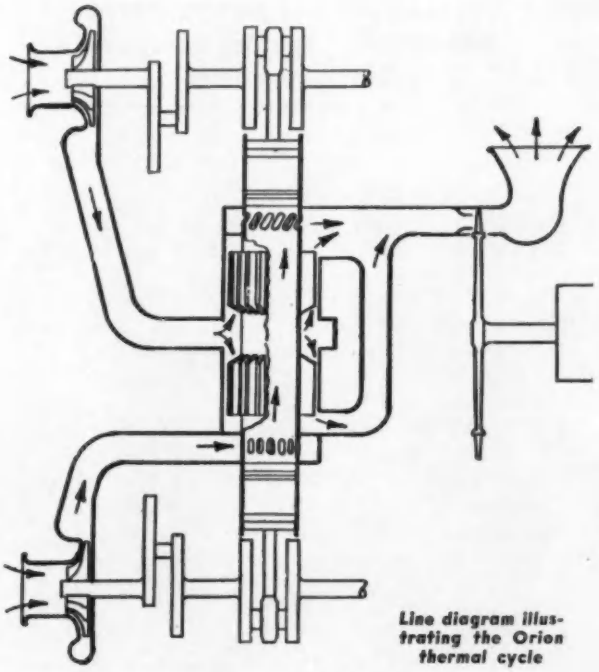
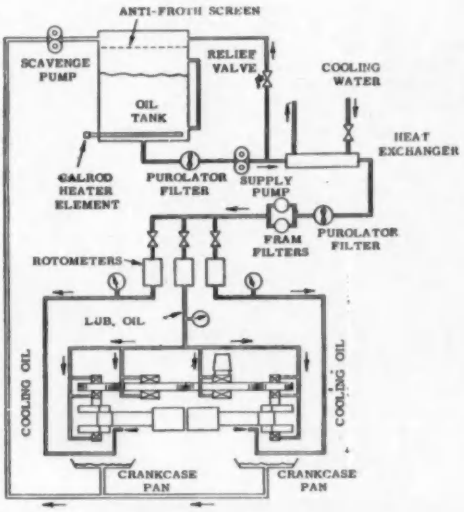
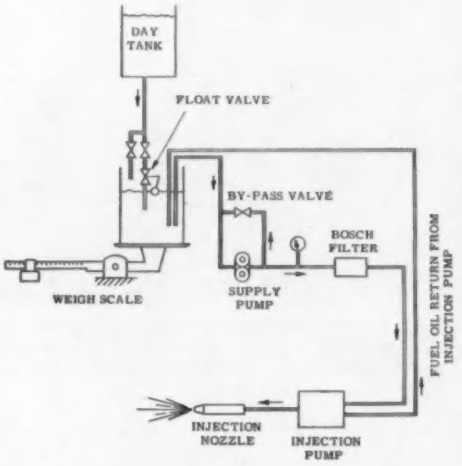


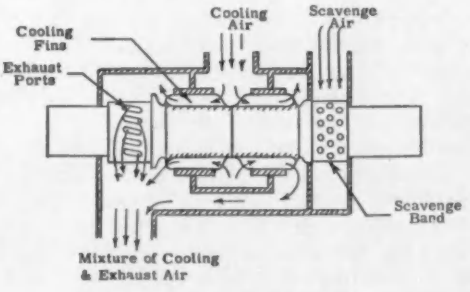
Line diagram illustrating the Orion thermal cycle



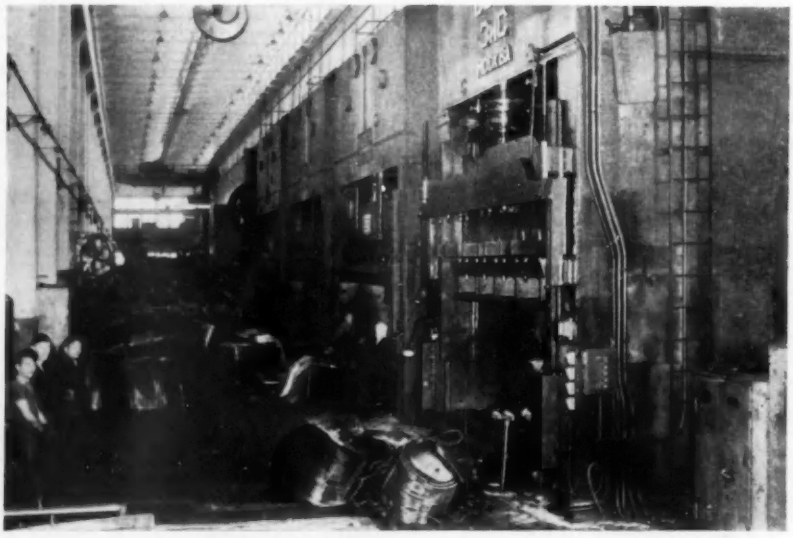
Cooling and lubricating cycle



Fuel oil system



Airflow passages of the engine



Behind the 750-ton Soviet press in the foreground are three 500-ton British Clearing units which Russia bought soon after the war and passed on to Poland in 1954. Pols in East Germany has supplied many of the newest machines in the press shop.

POLISH AUTOMOTIVE PLANTS

Tooled with Russian Machines

The 27 hp Syrena with a two-cylinder two-stroke engine has many parts in common with the larger Warszawa. Limited production is planned for the future.

BY DAVID SCOTT

An On-the-Spot Description of Automobile Production in Poland by one of AUTOMOTIVE INDUSTRIES' Special European Correspondents

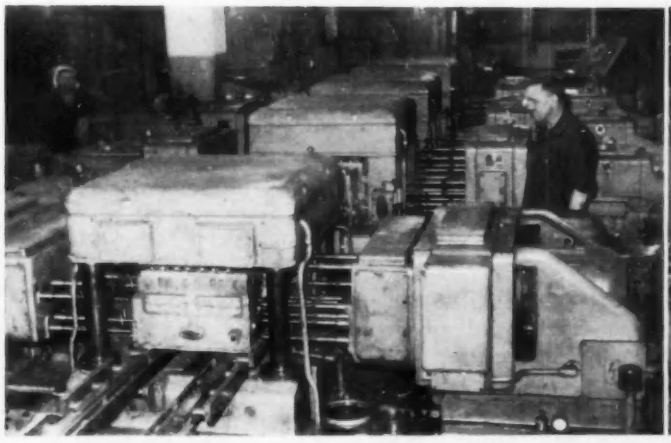
POLAND has succeeded in building a motor industry largely from scratch in the last 10 years, but so far it is operating inefficiently and output is small. This became evident during a recent visit to the country and inspection of several factories there.

Post-war industrialization was pursued at a breakneck pace despite insufficient trained labor, acute shortages of raw materials, and lack of experience. While rebuilding its war-devastated cities, Poland simultaneously tripled its production of steel and machine tools, doubled the output of electric power and chemicals, greatly expanded shipbuilding, and increased the production of capital goods 2½ times. With limited resources spread over so many projects, the result is that some of the big capital investments in the engineering sector have not yet paid off.

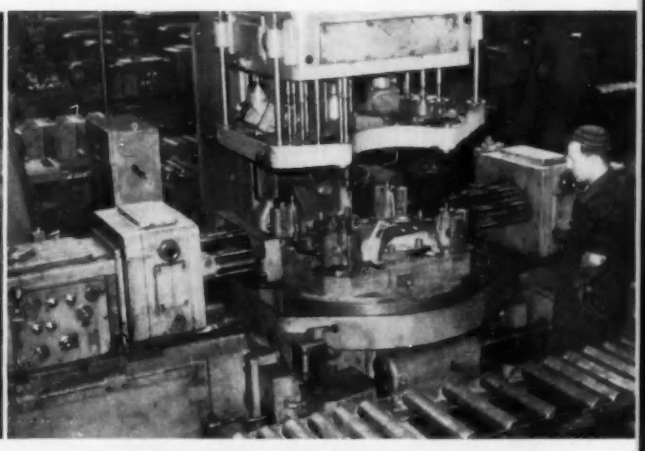
Before the war no vehicles were made in Poland aside from a few hundred assembled annually from imported parts. In 1938 only 34,000 road vehicles of all kinds were registered there, of which a quarter were trucks. Factory construction started soon after the war, with most of the equipment and machines supplied by Russia on long-term credit.

In 1947 the Ursus tractor plant near Warsaw began making a wheeled machine very similar to the Lanz Bulldog. A year later the locally-designed Star 20 3½-ton truck was first produced at Starachowice. By 1950 the assembly department of a new factory at Zeran, close to Warsaw, was completed and started turning out Russian Pobeda passenger cars. Similarly, a Polish replica of the Soviet 2½-ton GAZ 51 was introduced at Lublin in 1951. Later, manufacture of the Russian KD-35 crawler tractor was undertaken.

Official figures recently published give production in 1954 as 1678 passenger cars, 12,598 trucks, 316 buses, and 7808 tractors. Current output is probably considerably higher, but undoubtedly well below capacity in every case. Present difficulties are high-



Soviet-built transfer line for cylinder blocks has eight work stations with two multi-spindle heads paired on each horizontal slide.



Three-station rotary indexing machine for clutch housings. It has a single vertical slide for face milling, boring and drilling which spans the entire table.

Production of the restyled and improved Warszawa is expected to start soon. Engine output of this prototype has been raised to 65 hp at 3800 rpm, and the overall weight reduced by lightning various components.

lighted in the situation at Zeran.

This factory, comprising a complex of buildings on a 200-acre site, is now almost fully equipped for local manufacture of cars at the rate of 25,000 a year. These are the same Pobedas, but made locally under Russian license they are designated as Warszawa. Starting in 1950 the Soviets successively provided complete machine line and installations for various components, so that today 98 per cent of the parts are made in Poland, most of them at Zeran.

Total investment equals $200 million, and the plant compares favorably with some of the smaller west European ones. The layout for flow production, planned and executed by Soviet engineers, is good, and there is a complex network of overhead conveyors. Of the 4500 machine tools 70 per cent are Russian, including many automatic and semi-automatic types, the rest being Czech, East German and Polish.

About 50 bar and chucking automatics are in use, of which half are multi-spindle. There is one transfer line for engine blocks which drills, reams, taps and counterbores both end faces simultaneously. It consists of eight work stations and one inspection station, with hydraulic transfer and clamping mechanism. Adjacent multi-spindle heads on each side of the line are paired on a common slide, and share the same drive as well as feed motors. Cycle time is two minutes, and the operator stated that the line "gave no trouble."

Aside from this, major components are machined largely on rotary indexing automatics with work moved between them on adjacent roller tracks. A typical example of Russian-built equipment of this type is a three-station unit for clutch housings. This comprises drilling and tapping heads on horizontal slides at stations 1 and 3, and a single vertical head, spanning all three stations, for face milling, boring and drilling.

The crankshaft line, again entirely Russian, incorporates many semi-automatic machines. These include continuous drum-type millers for facing the ends, multi-head millers for turning the crank pins, main bearings and webs, and high-frequency equipment for induction hardening. Two of these electronic units are installed, and each has two positions for treating both crankpins and main bearing journals. The power plant is underfloor.

Work handling in the machining section is in sharp contrast to the modern equipment. Very little automatic loading was seen, and often heavy castings were manhandled from the roller track to the fixture.

(*Turn to page* 102, *please*)

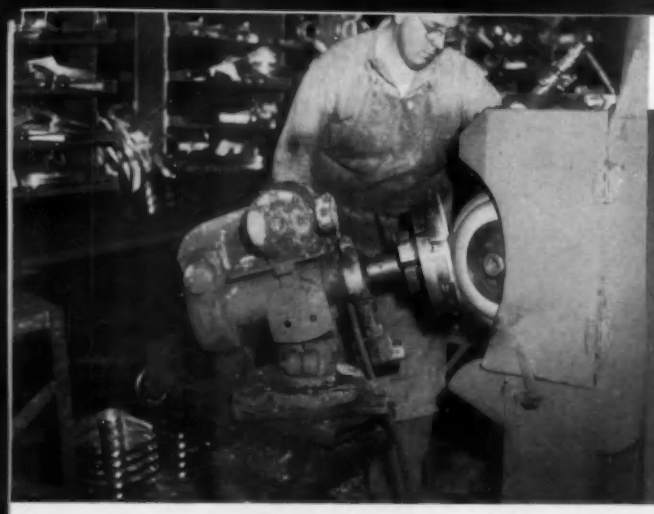
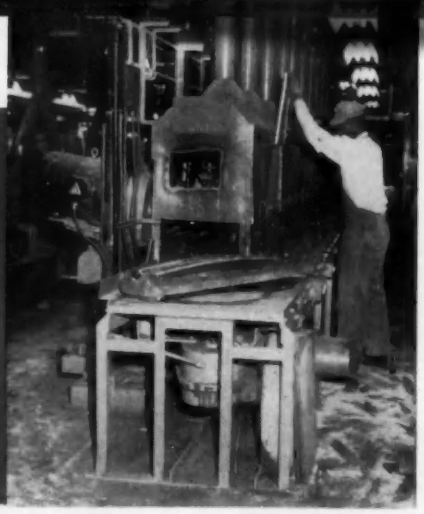


FIG. 1 ◀

FIG. 2 ▶



Semi-automatic buffing setup in use on a die cast horn ring. Loading and unloading of the rotating holder are done by hand but, otherwise, the operation is largely automatic.

Straight line buffing machine for grille header bars that are advanced around a conveyorized loop, two per fixture. During the circuit, the die castings pass under eight buffing wheels, each adjusted to buff a part of the casting surfaces.

AUTOMATIC BUFFING *and* Substitute Operations

BY HERBERT CHASE

FIG. 3 ▲

FIG. 4 ▼

DEMANDS for plated bright work on modern passenger cars continue at a high level and a part of this demand is met effectively by the new Syracuse, N. Y., plant of General Motors' Brown-Lipe-Chapin Division. Much new equipment was added when all automotive production was moved recently from an older Syracuse plant.

Many of the brightly plated components made by this plant are zinc alloy die castings that one department produces in large volume. They have the so-called "hardware" finish, which is remarkably smooth and, in general, needs only buffing or some equivalent to be ready for plating. Some grinding and polishing are done at die parting lines of the

FIG 3—
Loading a rear fender molding in a fixture that is rocked 90 deg after passing under four of eight buffing wheels in a straight line machine. A latch, released automatically at the proper point, holds the fixture in each of two successive positions. Fig. 4—Unloading a fender molding after buffing in the same machine shown in Fig. 3. Rocking fixtures are needed to permit all surfaces of the die casting to contact the required number of buffs.

FIG. 5

General view of the three-stage Gyro machine, one head of which appears in Fig. 6. Two heads can be seen in lifted position for indexing. Barrels are charged from the platform. Loading and unloading are done at a station on the far side, hidden in this view.

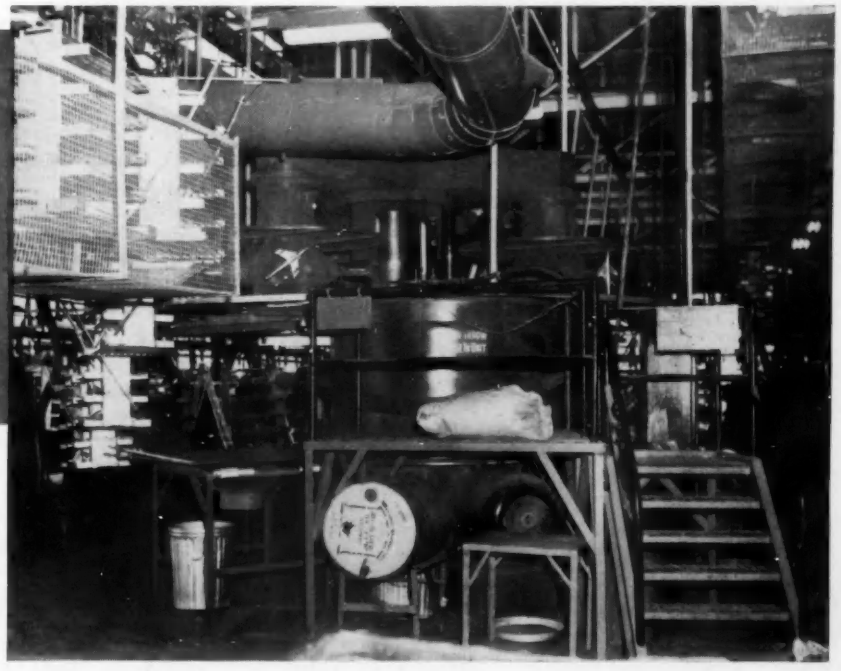
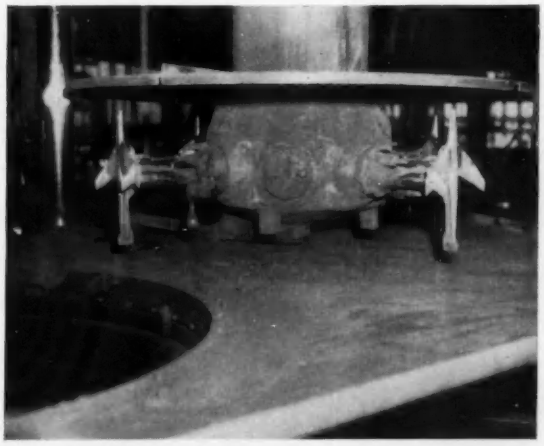


FIG. 6

Closeup of one head of the Gyro machine used to polish hood ornaments supported on four arms. At lower left is one barrel containing a slightly moistened mixture of ground corn cobs and tripoli.



castings and these areas also require buffing, hence this process continues important.

Buffing, however, creates much dirt that results from rapid wear of cotton buffs and from the use of compounds applied to the wheels. Both wheels and compounds are expensive and the dirt requires exhaust systems that involve cleaning and disposal problems. Nevertheless, buffing continues on a large scale although now being nearly eliminated by substitute operations on some parts, as described here.

Certain products, such as horn rings for steering wheels, having circular or part-circular form, are buffed largely on rotating fixtures similar to that in Fig. 1. Such work is fairly rapid and is largely automatic, save for loading and unloading the head by hand.

Parts such as header bars for Chevrolet radiator grilles, required in large volume, are done on "straight line" machines, one of which is shown in Fig. 2. These machines include a horizontal loop conveyor the function of which is to advance fixtures, each of which, in this case, holds two die cast bars whose upper surfaces are to be buffed.

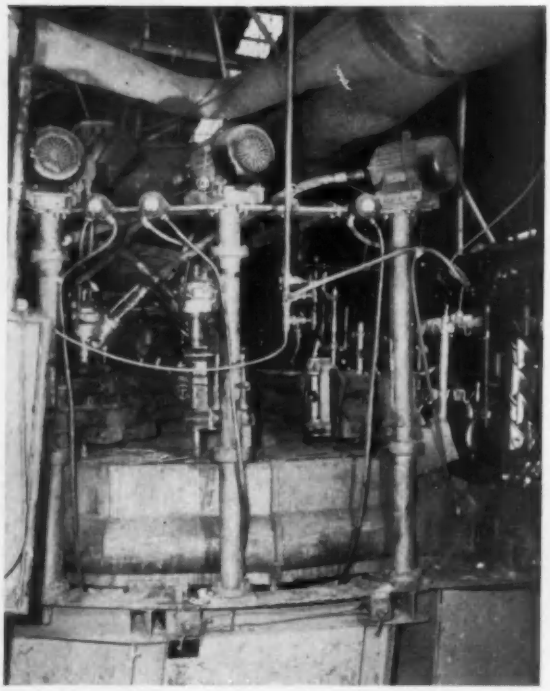
During the advance, the workpieces pass under several buffing wheels in succession, each wheel being set to engage a portion of the surface to be buffed. Liquid compound is applied to wheels at a controlled rate and, when the fixtures issue from the tunnel in which the wheels are located, the castings are ready for unloading and fixtures are reloaded before they start a new circuit.

Attendants at the machine perform loading, unloading, other handling and inspection, but output is much higher than for ordinary buffing on wheels (with castings handled one at a time) and skilled labor is not required. If adjustments are correct, buffing is uniform but occasional workpieces may require hand touchup work. Some hand work at a parting line is required on all of the header bars.

Similar work, also on a straight line machine, is done on a rear fender molding shown in Fig. 3 and 4. This zinc die casting has beads that run almost its full length and there is a large radius bend near the center, the two ends being nearly straight. It is necessary, therefore, to use rocking fixtures that present first one half and then the second half to the buffing wheels, of which eight, using liquid compound, are employed.

Loading of fixtures is done, as in Fig. 3, on the exposed portion of the loop conveyor that advances

FIG. 7



General view of the wet burnishing machine showing some of the 10 motors each of which drives, by flexible shaft, a mat inside the channel. There stampings dip into an abrasive slurry that is wiped across stamping surfaces by the mats.

the fixture and always with the fixture set in the same angular position. There is a horizontal pivot on the base of the fixture and the upper holding portion can rock approximately 90 deg about this pivot when a pivoted bell crank latch is released. This latch enters a notch in the first position but is released automatically by a cam after the fixture has passed under the first four buffing wheels of the machine.

When released, the fixture is rocked to its second position and the latch again enters a slot that holds the fixture in this position until the work is carried under four more wheels and reaches the unloading station, Fig. 4, where an inspector unloads the casting and inspects it as the fixture continues to the reloading station. As the ribs are parallel to the length of the casting and to the direction of motion, as well as to the planes of buff rotation, good buffing results.

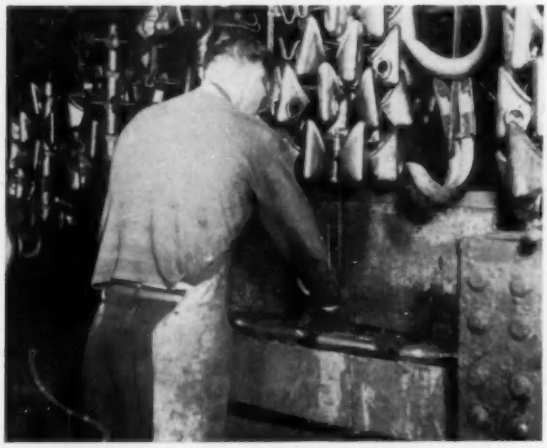
Other castings are buffed on automatic machines, including some having fixtures on a rotating horizontal table, but such setups are fairly conventional. Far more interesting are two much newer types of machines that yield results equivalent to buffing but that use no buffs and so avoid the disadvantages already mentioned.

One of these is a "Gyro" machine, Figs. 5 and 6, that employs a slightly moistened granular mixture to give die castings a bright finish and the other is a wet burnishing machine, Fig. 7, that uses a slurry. This latter yields very smooth, though somewhat frosted surfaces but the castings go directly to bright plating and come from the plating as bright as buffed castings similarly plated.

In the Gyro machine, Fig. 5, die cast hood ornaments are held in successive fixed positions while they are subjected to passage through a mixture of ground corn cobs, tripoli and sufficient water to slightly moisten the mixture yet still leave it dry enough not to cake. This mixture appears somewhat like sawdust but is lighter. It is held in barrels that are rotated about vertical axes and thereby subjects the castings to a constant flow of the mixture over their surfaces to be made bright and smooth.

Performance of the Gyro machine should not be confused with tumbling, as it does not involve any tumbling action. Each casting is supported independently, as Fig. 6 shows, and does not contact any of the three other castings treated at the same time in the same barrel. It is significant, however, that each supporting shaft is so arranged that it indexes 90 deg twice during the time that it is in each of two

FIG. 8



Loading-unloading station of the wet burnishing machine, showing part of the spider that advances fixtures loaded with bumper guard stampings through a wet slurry on the low side of the machine where rotating mats wipe the slurry over stamping surfaces.

barrels. As a result, the flow of the abrasive mixture, which is generally rotary, is across casting surfaces in three successive directions.

Consequently, all surfaces are "attacked" or polished by the flow, whereas, if the position of each casting did not change, some surfaces would be polishd much more than others. As it is, all exposed surfaces appear uniformly bright when castings are removed after treatment. (*Turn to page* 118)

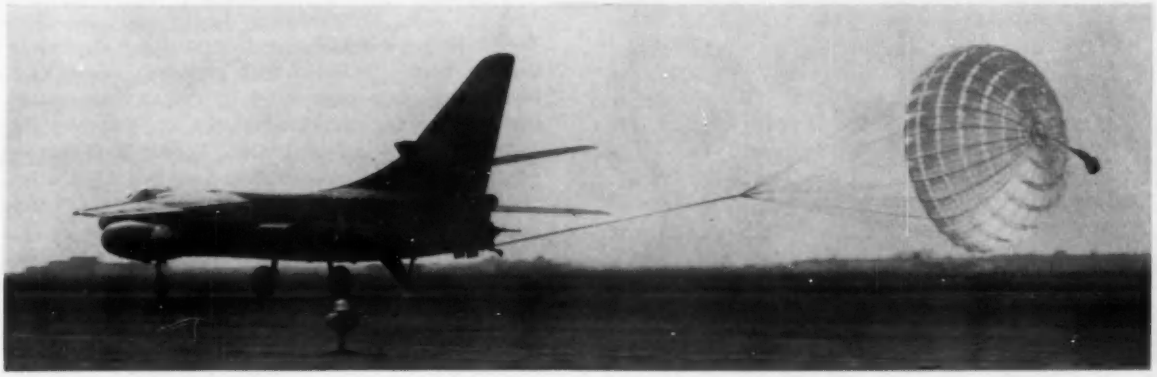
New AIRCRAFT Developments

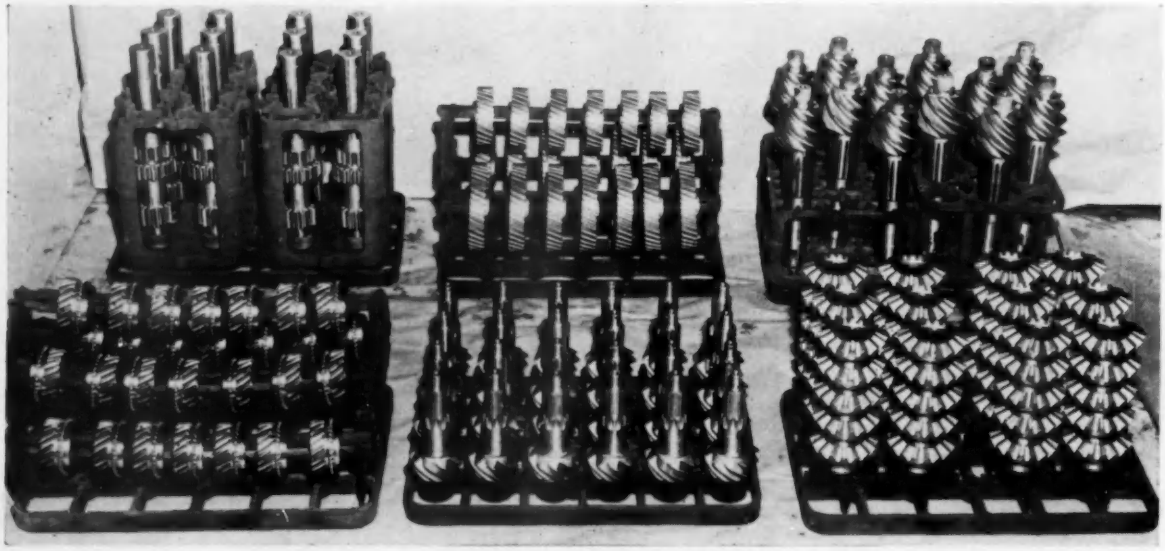
Lockheed final assembly crews position record-length wing and fuselage of the first Model 1649A Super Constellation on specially devised jigs in preparation for mating the two components. A 20-ton overhead crane lowers the fuselage into a cradle, while the wing rests in a lower rack below and forward of the position it will occupy in final configuration. After the fuselage is seated in the cradle, its temporary rolling gear will be removed.

Below—Lockheed's first record-length wing for the new Model 1649A Super Constellation on its nocturnal trip to the tank seal area before mating to the fuselage. The 150-ft wing, longer than any previous transport wing, is 23 ft longer than the airfoils on the other ships pictured. Tanks in the wing will hold 9600 gallons of fuel, enough for 6400 miles of nonstop flight.

The Boeing KC-135 was rolled from the Boeing Airplane Company's Transport Division plant in Renton, Wash., July 18. Minutes before, the last of 888 KC-97 piston-powered tankers had emerged from the factory, leaving Boeing completely in jet plane production. Here's how the apron looked with both airplanes out in the open.

A Douglas-Navy A3D Skywarrior rolls to a quick stop after opening its landing deceleration chute. All A3Ds will now be equipped with the new chutes.





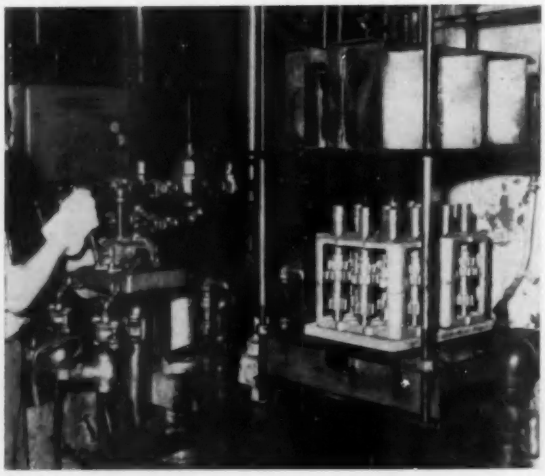
Typical loading of gears on fixtures, and fixtures on trays prior to gas carburizing. Fixtures and trays are made of HT cast high alloy.

Mass Marquenching Setup *for* Truck Transmission Parts

Representative Mechanical Properties Of Type HT Cast High Alloy
(Not Specification Values)

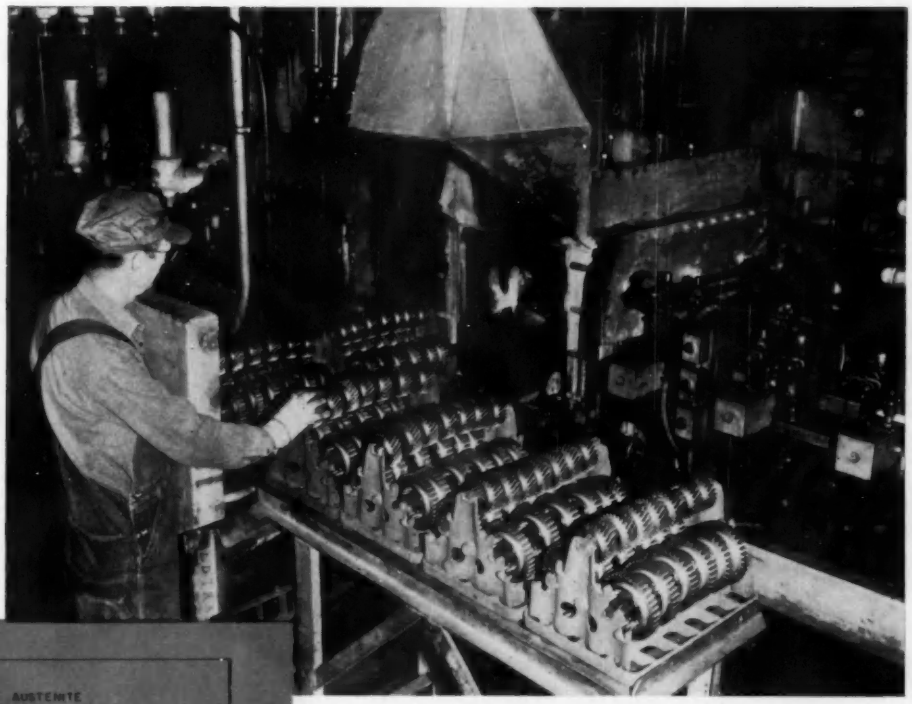
PROPERTY	TEMPERATURE 70F	1000F	1800F
Short Time Tensile Tensile strength, psi	70,000 (as cast)	10,000	11,000
Yield strength, psi (0.2% offset)	40,000 (as cast)	10,000	9,000
Elongation, % in 2 in.	10 (as cast)	28	23
Creep strength, psi (creep rate of 0.0001% per hr)	.....	4,000	2,000
Stress-Rupture, psi 100 hr	.....	8,000	4,000
1000 hr	.....	7,000	3,700

Tray of transmission countershafts ready to enter the marquenching bath. This part was formerly individually quenched.

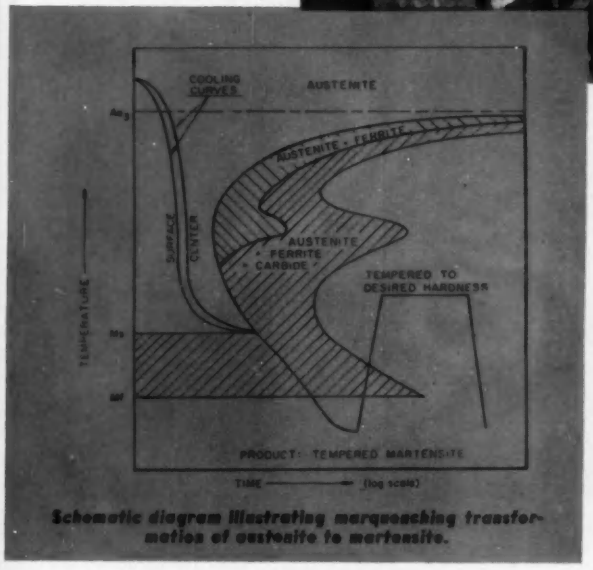


A MILLION-DOLLAR program for the modernization of heat treating facilities at the Fort Wayne Works of the International Harvester Co. has been completed with generous use of cast high alloy components. A new "mass marquenching" technique, developed at the company, is the heart of the new installation. Five gas furnaces, processing parts on specially-designed high alloy trays, are facilitating the carburizing of truck gears, king pins and shafts.

In marquenching, the hardening is from "inside-out," and for this reason is an excellent treatment for such heavily loaded parts as truck gears. The quenching procedure known as marquenching permits transformation of austenite to martensite by



Truck transmission parts on high alloy trays are loaded into gas carburizing furnaces at Fort Wayne Works of the International Harvester Co.



Schematic diagram illustrating marquenching transformation of austenite to martensite.

means of a type of interrupted quench, with oil at 400 F used as the quenching medium. This is carried out by placing the piece in the quenching bath at a temperature just above the M_s point of the carburized case, holding in the bath long enough to permit the piece to acquire the same temperature throughout, and then air cooling to room temperature. Transformation to martensite occurs during the relatively slow air cooling and, since the temperature gradient characteristic of conventional quenching is absent, the stresses set up by the transformation are much lower. Along with these lower stresses, there is much greater freedom from distortion and cracking.

In the program of modernizing heat treating facilities at the Fort Wayne Works, special attention was given to the battery of five radiant-tube gas carburizers, supplied by Surface Combustion Corp., used in connection with marquenching of the truck gears. These continuous carburizing furnaces have two rows each, accommodating 21 trays per row, on which the work is automatically charged into the furnace. The atmosphere in these furnaces consists of RX gas as a carrier, and 1050 Btu natural gas as an activator, in a ratio of 1250 cu ft RX to 35 cu ft of natural gas, with an atmosphere change of approximately 1.3 times per hour.

These furnaces are operated in different cycles, according to one of three specified case depths on the parts: 0.025 to 0.035 in.; 0.031 to 0.047 in.; or 0.047 to 0.063 in. The close control maintained in the new setup results in a concentration of carbon which is considered optimum for hardness of structure. Because of the limitations of the former method, the surface carbon concentration was held in the range of 1.10 to 1.20 per cent on all types of carburized parts. As a result of an extensive investigation, the new furnaces are arranged so that the surface carbon concentration is between 0.85 and 0.95 per cent.

The all-important quenching operation is accomplished in a 1600-gallon-capacity quench tank of special design, located at the side discharge door of each furnace, so that the material discharged onto an elevator is submerged in the 400 F oil. The tank is designed so that the flow of oil is greatest at the submerged level. The timing of the quench

(*Turn to page* 120, *please*)

Training for Aircraft Production in Boeing Plants

By Reginald Perry
Bureau of Apprenticeship
U. S. DEPARTMENT OF LABOR

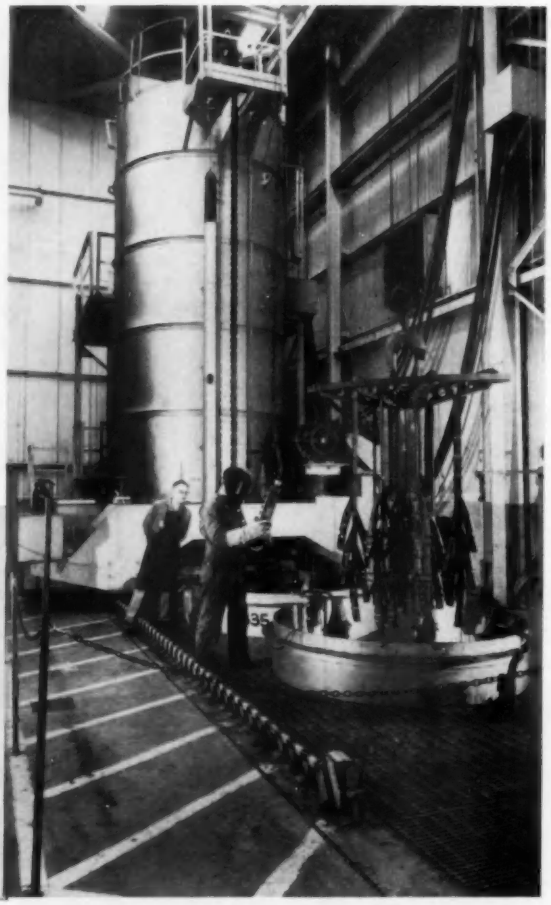
APPRENTICE TIME AND WORK PERFORMANCE RECORD

NAME JOHN C. KINDER DEPT. 703 CLOCK 62 SHIFT 1

TRADE A AND E APPRENTICE CURRENT WAGE RATE 2.17.5 MONTH NOV. 55

	DATE	CODE	UNIT OF WORK	CLOCK HOURS INCL. OVERTIME	SIGNATURE OF FOREMAN
FIRST WEEK	11/1/55	DD	SHP PRS PLT	8	
	11/3/55	DD	SHP PRS PLT	8	
	11/3/55	DD	SHP PRS PLT	8	
	11/4/55	DD	SHP PRS PLT	7	
					A B Smith
	11/4/55		RELATED TRAINING	41	
SECOND WEEK	11/7/55	DD	SHP PRS PLT	8	
	11/8/55	1	TEMPLATE	8	
	11/9/55	1	TEMPLATE	8	
	11/10/55	1	TEMPLATE	8	
	11/11/55	1	TEMPLATE	8	
					A B Smith
			RELATED TRAINING		
	11/14/55	1	TEMPLATE	8	

Part of an apprentice's time and work performance record



Apprentice operating heat treating furnace

Apprentice Wages

APPRENTICES

First 6-month period (1000 hours)	$1.29	per hour
Second " " " "	$1.39	" "
Third " " " "	$1.49	" "
Fourth " " " "	$1.59	" "
Fifth " " " "	$1.67½	" "
Sixth " " " "	$1.80	" "
Seventh " " " "	$1.98½	" "
Eighth " " " "	$2.17	" "

TOOL AND DIE MAKER APPRENTICES

Ninth 6-month period (1000 hours)	$2.35	per hour
Tenth " " " "	$2.41½	" "

WITH the continuing pressure for production in the aircraft industry, the rapid changes in design and complicated structures, the demand for increased manpower and skills required are never-ceasing.

In 1955 the industry turned out more than 12,000 planes. The new year started with a large backlog, and a heap of new orders piling up. At the beginning of the year there were 800,000 workers in the aircraft plants—an all time high, second only to the number in the automobile industry. There is no way of predicting how many more workers will be needed this year and during the next five years, but it is certain that to be sure of an adequate force of thoroughly competent workers, special training will be required. This will include training for the all-

Work Schedule for Aircraft Mechanic Apprentices

	Hours
Bucking	160
Riveting	320
Assembly	160
Shear, Brake, Roll, Erco	320
Hand Forming	80
Punch Press	80
Welding	160
Sheet Metal Layout	*360
Template Layout	*360
Tubing, Flare, Pressure Bend	320
Cables & Hydraulics	*200
Upholstery & Pattern Layout	80
Wire Cutting—Solder	280
Wire Diagrams	*360
Cable Rigging & Installation	160
Electrical Installation	320
Structure Installation	*360
Wing Parts, Access. Installation	*360
Bulkheads, Floors, Skin, Cir., Ream	240
Functional Test—Electrical	*200
Functional Test—Hydraulic	*200
Power Pack or Jet	*360
Propeller Assembly—Balance	80
Hydraulic & Fuel Equipment—Bench Test	160
Electrical Equipment—Bench Test	*200
Instruments—Oxygen Bench Test	80
Preflight Operations, Inc. Tool Room & Sh. Clerk	*1320
Electronics, Comm., Arm.	*360
Experimental Preflight, Methods Study	*360
Assign. under Supt.—900 Division	
Breakdown; Job Assign.; Rework; Related Training; Test Panels; Spec. Install.; Equip. Tests	
Total	8000

* Indicates placement of the 600 hours of related training.

On-the-Job Work Schedule for Aircraft Machinist Apprentices

	Hours
Department Clerk	160
Tool Room	160
Bench, Roto-finish, Straightening	280
Drill Press	680
Shaper	240
Carbide Tools—Induction Brazing	200
Heat Treat	360
Layout—Elementary	200
Turret Lathe	840
Engine Lathe	840
Lucas—Jig Mill	320
Tool Grinding	320
Layout—Advanced	320
Milling Machine	1080
Profile Milling Machine	520
Production Grinder	1080
Process Planner	200
Precision Inspection	200
Total	8000

round, highly skilled work performed by craftsmen; training for the wide variety of jobs not requiring a craftsmen's versatility; replacement training; periodic training of seasoned workers to keep them abreast of the latest and most advanced production methods and techniques.

The Boeing Airplane Co. is setting an example in training for the industry. The company has had long experience in training workers in the multitude of jobs required in airplane manufacturing. With its big production plants in Washington and Kansas, turning out the famous KC-135 Jet tanker-transport and Boeing 707 Transports, B-52 series, the C-97 Stratofreighter, and the B-47 Stratojet, the Company has had a colossal manpower and training undertaking on its hands. What the training program includes and how it was developed makes a story of special interest to a good many aircraft manufacturers large and small.

Apprentice Training Major Consideration

The major consideration at Seattle has always been the training of apprentices for craftsmanship. It is the craftsmen—the all-round skilled workers—who are depended upon to transform the blueprints into the finished product. Their work and the work of the engineers and scientists are inter-dependent. Few in number compared with the entire work force, they form the nucleus around which the operations in the plant revolve.

Boeing's apprentice training program was first established in Seattle in 1940, with the assistance of representatives of the U. S. Department of Labor's Bureau of Apprenticeship. Since then the company has had apprentices in training continuously. The great majority of those completing their apprenticeship are still employed in the company's plants, and about 40 per cent of their number have been promoted to supervisory positions.

Boeing has also been training annually thousands of other workers for jobs requiring varying degrees of skill.

In training in Seattle at the beginning of this year were 80 machinist and tool and die maker apprentices, and 58 aircraft mechanic apprentices—138 in all. This was approximately one apprentice to every seven qualified machinists and mechanics in those trades. The company has been employing about the same proportion of apprentices to journeymen ever since the apprenticeship program was originally planned.

The term of apprenticeship in the machinist and aircraft mechanic trades is 8000 hours or about four years, and in the tool and die maker trade it is 10,000 hours or five years.

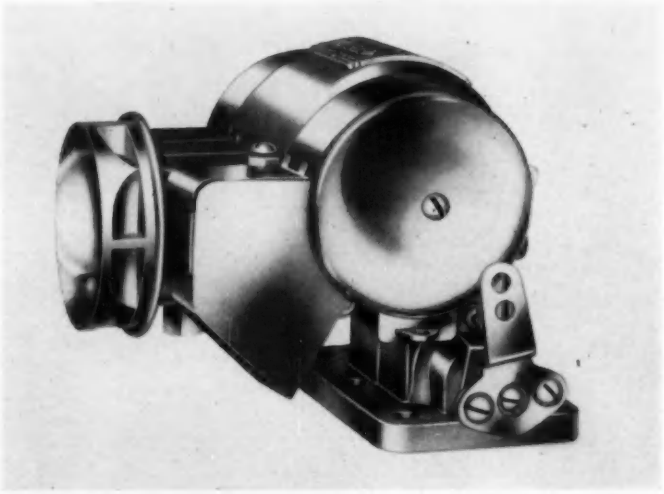
The apprentices learn by doing and earn while learning. They are trained on-the-job in the plants where they become part of the working force. They begin to produce almost at the very start of their training. Their production and value to their employer increase as their skills increase. Their wages advance after successful completion of each 1000 hours of their apprenticeship. In addition to their on-the-job training, apprentices have the advantage of classroom instruction in subjects related to their work which cannot be readily learned on the job.

Joint Apprenticeship Committee

The apprenticeship program is conducted under the general supervision of the Training Director, J. A. Olmer, who cooperates closely with a six-man management-labor apprenticeship committee. The chairman of the committee is Donald J. Strayer, representing the Aeronautical District Lodge Inter-

(*Turn to page* 109, *please*)

Construction and Operation of



Model 200 Meteor Fuel Injector unit to replace two and four barrel carburetor installations.

THERE has been some interest generated in recent months concerning pressurized carburetors for passenger car engines. This development is thought of by some engineers as perhaps the logical step-up on the way from conventional carburetors to direct fuel injection.

Currently, there is one such unit—the Meteor Fuel Injector — in production. Designed and produced by Saaty Fuel Injector Corp. in Providence, R. I., the unit is interchangeable with present-day carburetors. It injects fuel into the intake manifold under slight pressure instead of depending upon engine vacuum. This system, referred to as manifold injection or low pressure injection, has been used for some time in aircraft engines.

The Saaty Meteor unit premixes the gasoline and air within its nozzle, forming an emulsion which is then sprayed into the air entering the manifold in a controlled spray pattern. Injection of the fuel takes place in a stream of air traveling at high velocity, at a point at which a vortex effect causes a swirling motion providing a high degree of atomization. The throttle is mounted at the air horn of the unit so that the pressure differential between the atmospheric air pressure and the manifold depression is fully utilized to provide the forces which give both control and atomization.

The schematic diagram showing a cutaway portion of the injector illustrates the relative positions of the throttle and the air valve with the basic principles of the linkage which controls the nozzle. Air which passes the throttle impinges upon the air valve depressing it so that the combined velocity and density of the air are in effect measured by the position of the air valve at all speeds and loads. Motion is transmitted from an arm moving with the air valve shaft, through linkage to a pivoted or fulcrum motion to the control arm which regulates the flow of fuel through the nozzle.

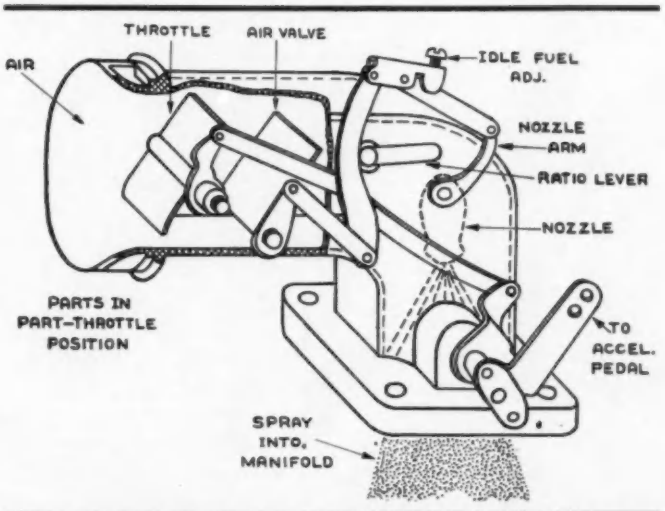
Fuel-air ratio is determined by the linkage motion and is established at the factory. The diagram illustrates a simple principle by which the mixture ratio is altered during warm-up of the engine by changing the position of the fulcrum point defined as "ratio lever." Positioning of this lever, which provides the enriched mixtures for starting and warming up of the engine, is accomplished by either manual control or by an automatic thermostat device. Starting mixtures are obtained by depressing the accelerator which causes the nozzle to spray a priming mixture.

When the ignition is off, the air valve returns to a shut-off position, as the flow of air ceases. This shuts off the nozzle and retains pressure in the fuel section.

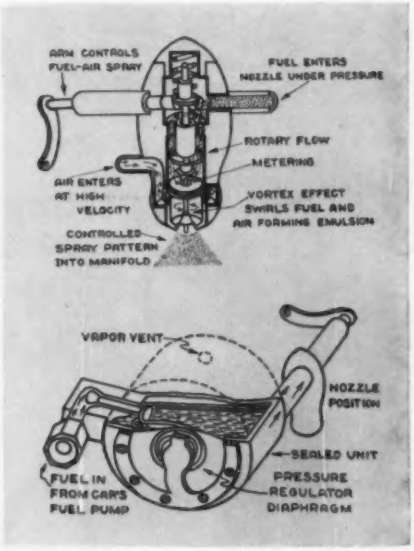
Gasoline enters the injector under pressure of the fuel pump and thence through a pressure regulator which delivers the fuel to the nozzle under a pressure of one psi.

Fuel passes through the metering chamber and through the metering orifice which is so constructed that it is self-clearing of any small dirt particles in the gasoline. The metering orifice is 5/64 in. diam. After being metered in proportion to the air which controls the air valve, the fuel is injected into the swirl chamber where the atomizing and emulsifying stage takes place. Air is admitted at high velocity through slots giving a rotary pattern and the swirling results in emulsifying the gasoline. Because the nozzle next sprays the emulsion into the manifold in the path of the air entering the manifold at high velocity, high pressure differentials develop which rise to 8 to 10 lb of atomizing pressure at cruising speeds. Pressure drops and spray pattern are controlled as the metering takes place so that as much as possible of the incoming air is mixed with the atomized fuel-air mixture which has been already prepared, so as to give a fog like mixture to the cylinders.

the Meteor Fuel Injector



Main operational principles of the manifold injector.


ARM CONTROLS FUEL-AIR SPRAY
FUEL ENTERS NOZZLE UNDER PRESSURE
ROTARY FLOW METERING
AIR ENTERS AT HIGH VELOCITY
VORTEX EFFECT SWIRLS FUEL AND AIR FORMING EMULSION
CONTROLLED SPRAY PATTERN INTO MANIFOLD
VAPOR VENT
NOZZLE POSITION
SEALED UNIT
FUEL IN FROM CAR'S FUEL PUMP
PRESSURE REGULATOR DIAPHRAGM

Top drawing shows nozzle operation of the Saaty low pressure injection unit.

Bottom drawing shows fuel section of the injector which is sealed at the factory.

Main body of the Meteor is a die casting with another die casting comprising the fuel tank. This is a sealed unit containing a simple pressure regulator and a vent to release vapors from the gasoline while maintaining operating pressure in the chamber. Other than the two die-cast parts, the remainder of the parts are about equally divided between screw machine parts and stampings. Stainless steel is freely used wherever parts are in contact with the gasoline and any other steel parts are protected by either cadmium or chrome plate. Brass parts are principally used in contact with gasoline. They are also used for hubs or bearing surfaces.

Saaty just recently brought out its new model 200 injector for V-8 engine installations. The firm has been producing its Model 100 for in-line engines since 1953. The new model 200 Meteor injector is made in an L-shape with the air horn in a horizontal position. Saaty has developed a special air filter for the new model so as to conform with modern low hood designs.

• • •

GM Remains Top Producer In Canada for First Half

During the first half of 1956, despite a strike which closed factories down for seven weeks, General Motors of Canada, was the largest producer of Canadian passenger cars, in accounting for 34.3 per cent of the total produced. Ford of Canada, produced 33.8 per cent, Chrysler, 27.7 per cent, Studebaker-Packard of Canada, 2.5 percent; and American Motors, Ltd., 1.7 per cent.

In truck production, General Motors of Canada also led with 40 per cent of total production; Ford 31.4 per cent; International Harvester of Canada, 16.5 per cent; and Chrysler, 12.1 per cent. Studebaker-Packard has produced no trucks thus far this year.

Car Rental Growth Is Cited By Hertz

Car rental companies are certain to continue to be among the automobile industry's biggest customers. In the past 10 years, the car rental business has grown by such phenomenal proportions that many companies have had to enlarge their fleets continually to meet the rising demand for quick and convenient transportation.

Hertz Rent-A-Car System, Inc., notes that it made more than 2.4 million car rentals last year. Today, the company has car rental facilities at nearly 500 locations, including airports and railroad terminals, a far contrast from 10 years ago, when the company had facilities at only three airports.

Nearly 75 per cent of the company's business comes from out-of-town customers, particularly businessmen making one-day trips. Hertz recently announced that it plans to purchase 14,000 more vehicles for its fleet.

MATERIALS
in the
Automobile of the Future

By A. L. Boegehold
GENERAL MOTORS CORP.

THE need to conserve our dwindling supplies of high-grade ores as well as to take some of the pressure off an overburdened steel industry will undoubtedly result in the use of more and more light alloys in automobile construction. The present rate of consumption of steel — the automobile industry accounts for approximately 25 per cent of the total amount — is especially wasteful in view of the fact that a substantial amount of the metal is not recoverable due to the high rate of corrosive attrition. If a substantial part of the automobile components were to be constructed of light alloys and plastics in some form, as seems likely, the current drain on the world's supplies of high-grade iron ore, to mention one example, would be considerably lessened.

ALUMINUM

The two most likely substitutes for steel in automobile construction would appear to be aluminum and magnesium, neither of which is as yet in short supply. The changeover to aluminum has already taken place in automatic transmissions. A logical extension of this changeover will undoubtedly result in some form of die cast aluminum cylinder block; one such model has already been announced by a prominent Toledo firm.

Aluminum will predominate in other engine components. The cylinder head will be of aluminum, the oil pan and other covers of magnesium. Valves will continue to be of heat resisting alloys, supplemented universally with aluminizing both on intake and exhause. Figure 1* gives a summary of how aluminized valves compare in performance with valves that are not aluminized.

The intake manifold will be aluminum, and the exhaust manifold will remain cast iron. The pistons will continue to be of aluminum alloy. The degree of low expansion of the piston alloy may be modified, however, to make it more compatible with wet aluminum liners. The aluminum liners will, of course, be faced with some wear resistant material comparable to chromium plate, or better. Piston pins and connecting rods will remain unchanged. Bearings will continue to be steel backed inserts of the Durex 100 or Moraine 400 type. Durex 100 consists of a copper nickel porous sintered matrix bonded to a steel back and overlaid and permeated with a lead base babbit. Moraine 400 consists of an aluminum base silicon cadmium alloy bonded to a steel back with a thin overlay of lead base babbit.

It is becoming evident that when the finished component cost is compared, there is very little difference between aluminum and cast or malleable iron. Although the cost per pound of aluminum is high, the cost per part is the same, because a part made of aluminum weighs only a third as much as the same part made of cast iron. Stated another way, the cost per cubic inch of iron and aluminum are nearly the same. Added to this, the machining cost for aluminum is much less than for cast iron; and many parts that can be made as die castings, or permanent mold castings, are more accurate and closer to finish dimension than iron castings and so require less machining.

CRANKSHAFT

In the case of the crankshaft, the accent is more on the process by which it is made than on materials, since the choice of a process will naturally dictate

(*Turn to page* 112, *please*)

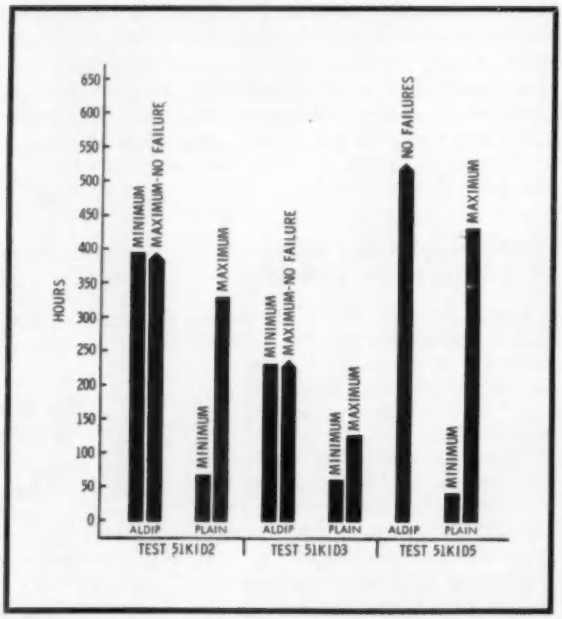


Fig. 1—Improvement of valve life by Aldip aluminum dipping

* "Engine Valves Improved by Aldip Coating," by R. F. Thomson, D. K. Hanink, E. B. Etchells, and K. B. Valentine, SAE Meeting, March 1, 1955.

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TO 2000 PSI HYDRAULIC PRESSURE

Output Range: 200 to 10,000 psi Fluid

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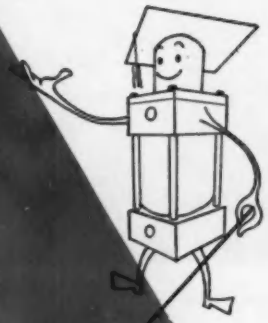
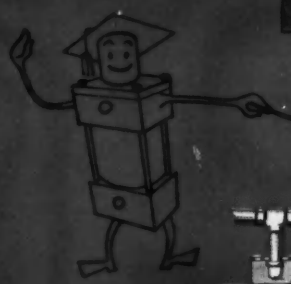
NOTE: In addition to its most complete line of "Custom-Built" Boosters available on normal delivery, Miller offers 5" bore, 25 to 1 ratio boosters for immediate delivery in either 6" or 12" stroke. Write for data and prices.





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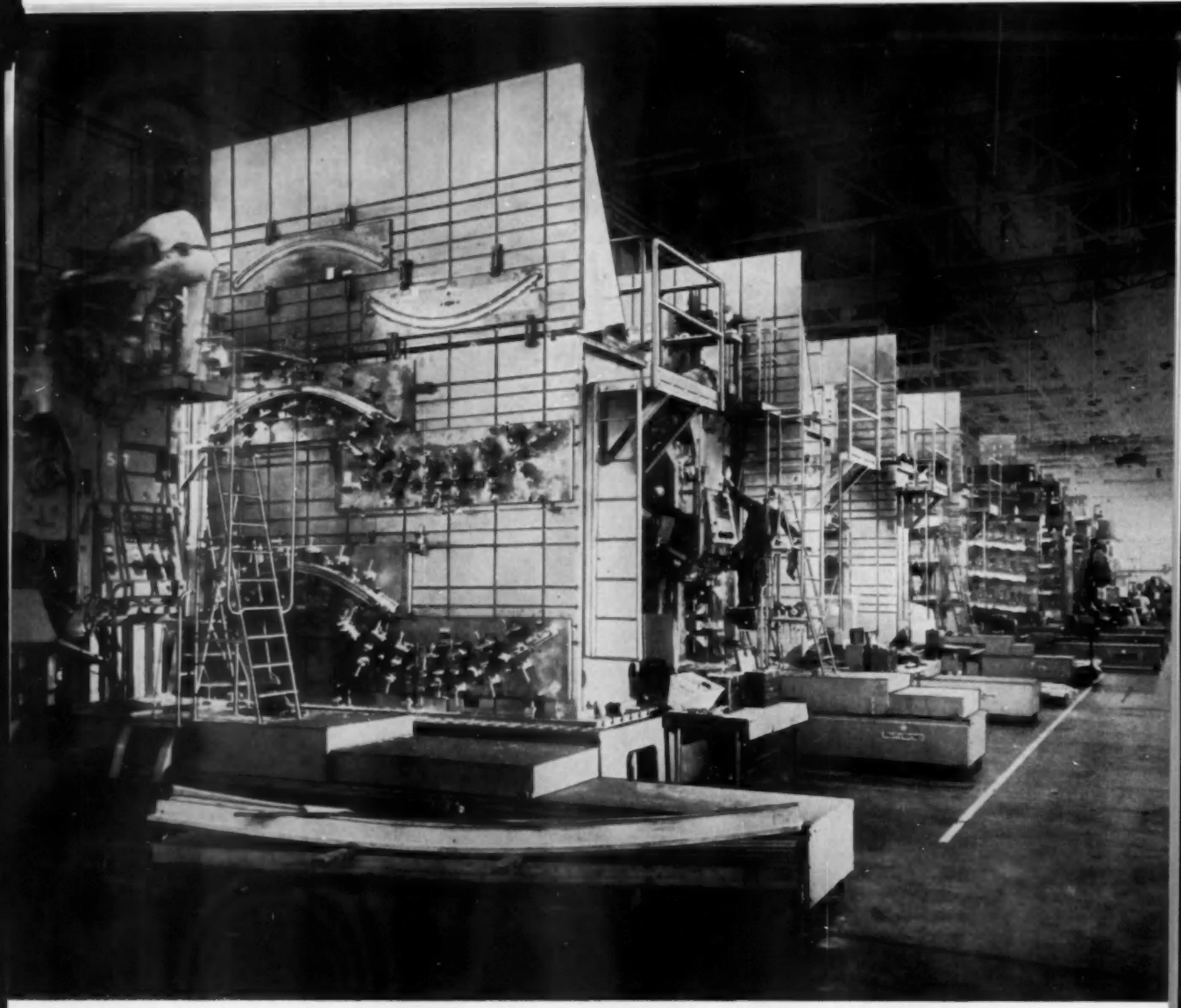
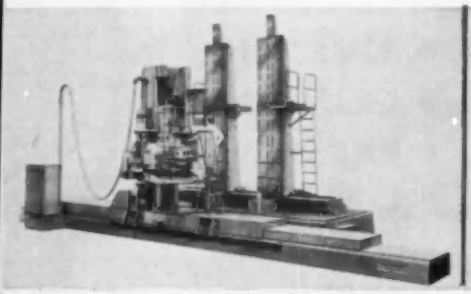
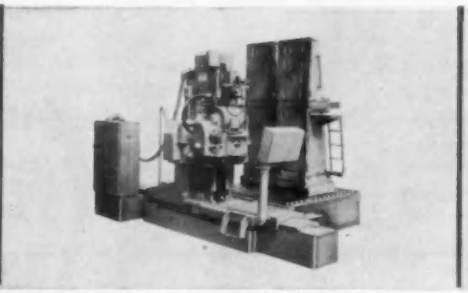
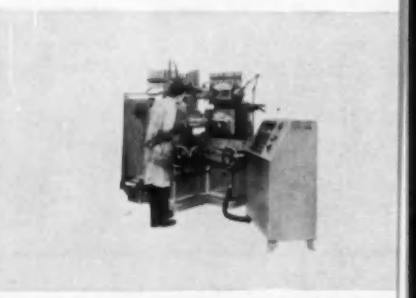


GIANT

shape the future





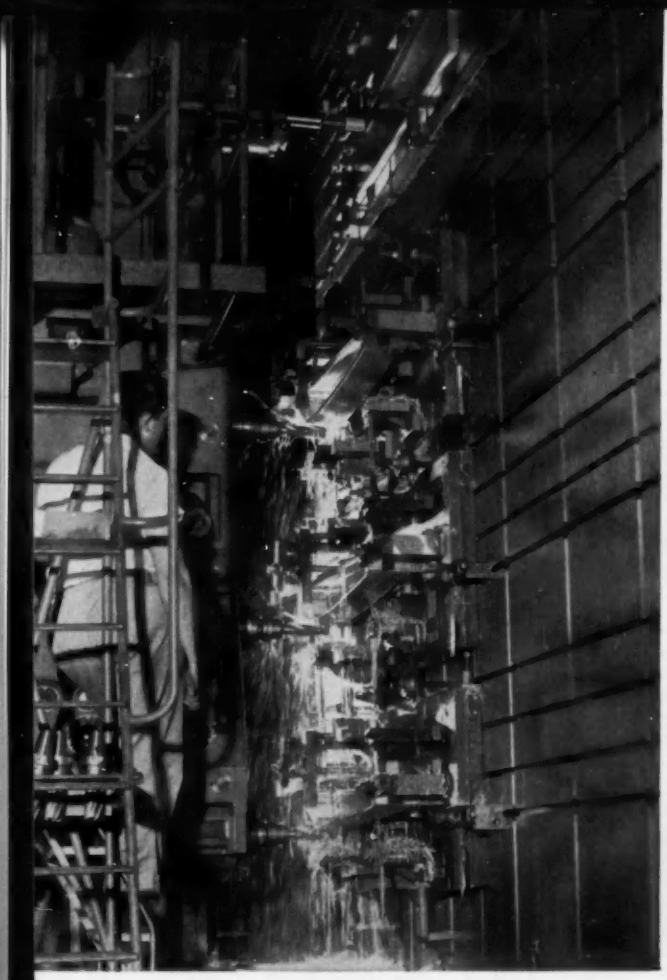


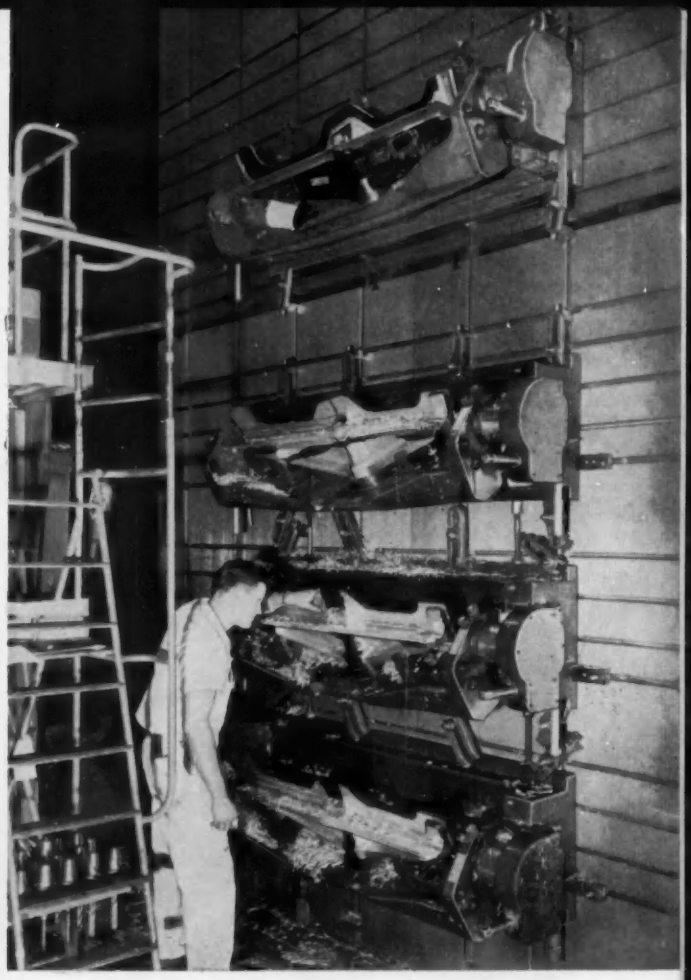
MULTI-MILLION DOLLAR PLANT... OR SMALL SHOP—There's a complete line of Pratt & Whitney KELLER Machines with models to handle *every* work size profitably.

TYPE BG-22—A big machine with capacities to 20′ x 7′. Single and 3-spindle models.

TYPE BG-21—Two standard sizes: 5′ x 2½′ and 6′ x 4′. Single and 2-spindle models.

TYPE BL–Smallest KELLER with capacity of 36″ x 20″. Single and 3-spindle models.





The use of two and three-spindle KELLERS provides rapid output geared to tight schedules. One noted manufacturer is counting heavily on KELLERS to help produce 150-foot airliner wings on a five-a-month basis and fill $90 million worth of orders.

Augmenting the already great versatility and productivity built into all KELLER Machines, Tool Engineers have developed ingenious trunnion fixtures (like those shown in the adjacent picture) that make it possible to re-position the components quickly for several successive machining operations . . . *without* production stops to remove the work and change fixturing.

KELLERS

of jet age production

These on-the-job scenes taken in the plant of a leading aircraft manufacturer typify the swing to KELLER throughout the Aviation Industry. To provide the maximum strength-with-lightness necessary to withstand the terrific stresses of jet age flight, increasing numbers of large, complicated components are being forged as single units and then machined over their entire surface. And making it possible to mill accurately all the complex, 3-dimensional shapes involved — on an efficient, production basis—are these rows of Pratt & Whitney BG-22 KELLER Tracer-Controlled Milling Machines . . . powerful, versatile giants that handle a wide variety of large workpieces.

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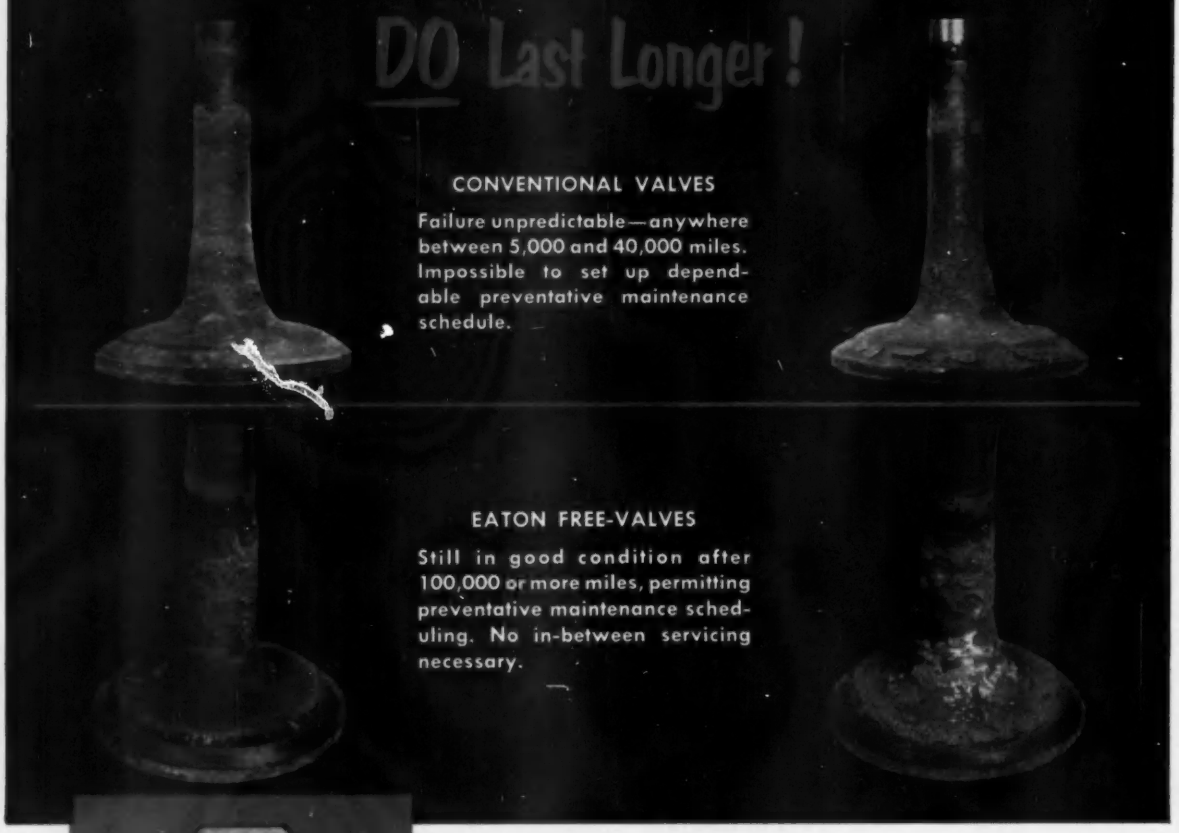
CONVENTIONAL VALVES
Failure unpredictable—anywhere between 5,000 and 40,000 miles. Impossible to set up dependable preventative maintenance schedule.
EATON FREE-VALVES
Still in good condition after 100,000 or more miles, permitting preventative maintenance scheduling. No in-between servicing necessary.

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The common goal of valve and engine manufacturers—and truck operators—is to obtain valve life equal to that of other major components, thereby eliminating the necessity for valve servicing between major overhauls. Performance records covering millions of miles of heavy-duty operation prove that Eaton Free-Valves have achieved this goal.

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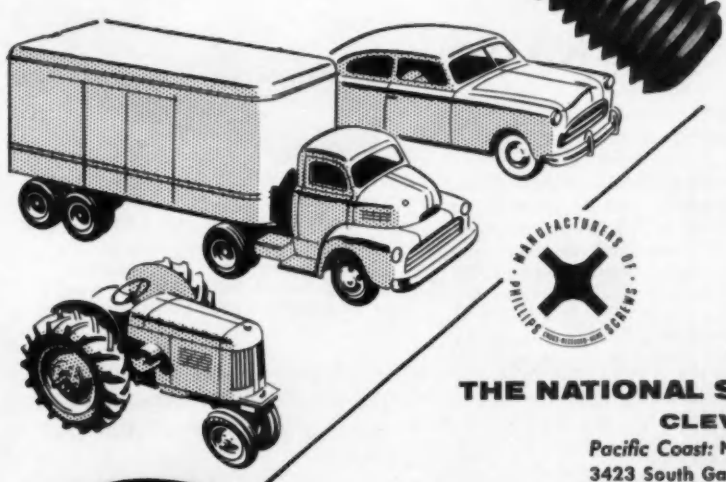

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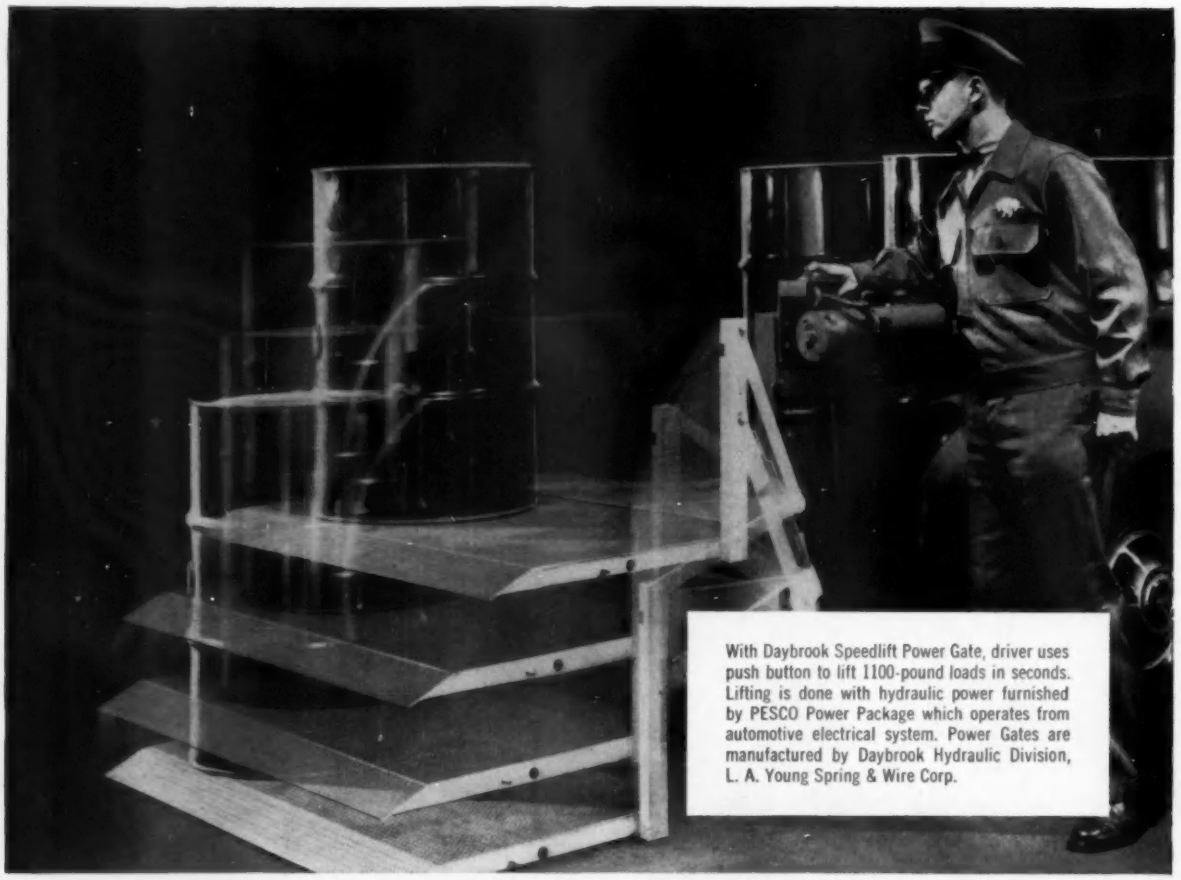

With Daybrook Speedlift Power Gate, driver uses push button to lift 1100-pound loads in seconds. Lifting is done with hydraulic power furnished by PESCO Power Package which operates from automotive electrical system. Power Gates are manufactured by Daybrook Hydraulic Division, L. A. Young Spring & Wire Corp.

hydraulic power at the push of a button

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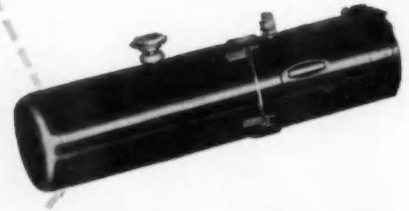
If you need to produce hydraulic power from an electrical source, investigate PESCO's line of Hydraulic Power Packages.

These low-cost units are versatile and find extensive application on tailgate loaders, lift trucks, small dump bodies, farm tractors and snow plows. They provide hydraulic flow to .80 gpm at pressures to 2000 psi from any suitable 6, 12 or 24-volt d-c source.

PESCO Hydraulic Power Packages include an electric motor, hydraulic gear pump with integral relief valve, check valve and reservoir in a single, self-contained assembly. The PESCO gear pump features "Pressure Loaded"* bearings for higher volumetric efficiency and longer service life.

Original equipment manufacturers are invited to obtain price quotations or specific information from your nearest PESCO sales engineer or write: PESCO, 24700 North Miles Road, Bedford, Ohio.



PESCO HYDRAULIC POWER PACKAGE converts electrical power to hydraulic, finds wide industrial use. Compact "package" design contains motor-driven gear pump, relief and check valves and reservoir.

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Producing the Best in Hydraulic Pumps, Fuel Pumps, Electric Motors and Axial Flow Blowers

News of the MACHINERY INDUSTRIES

By Thomas Mac New

Increased Demand for Imported Machine Tools in Australia as Market for Domestic Equipment Falls Off. Sales of Optical Grinding Machines at New High in U. S.

Warner & Swasey Plans 25 Per Cent Expansion

To meet expansion plans costing about $2.8 million and other capital expenditures of $3 million, Warner & Swasey Co. of Cleveland proposes to float a common stock issue of 120,000 shares. Monies derived from the issue plus funds on hand should be enough to handle the program, according to company officials. The $2.8 million will be used for the construction of additional manufacturing space at its existing plans and the acquisition of additional machinery and equipment to increase its productive capacity by 25 per cent. SEC reports that the company has filed a registration statement for the stock issue.

Air Force Accepts Farnham Mill

The first of 30 AIA-type spar milling machines manufactured by the Farnham Manufacturing Div. of the Wiesner-Rapp Co., Inc., Buffalo, has been accepted by the Air Force. The spar milling machine is the first to be delivered in a $6 million order which the Air Force placed with Farnham a year ago. Balance of the order will be completed during the next 18 months at the rate of about two a month. The contract calls for 17 single-carriage spar milling machines with straight horizontal heads, four single-carriage machines with straight vertical heads, and nine double carriage machines with horizontal twist heads and vertical twist heads.

Australian Machine Tools Going Down Under

Imports of machine tools in Australia are increasing at a rate of something more than 20 per cent yearly as machine tool production in that country has hit the skids. Particularly in the last six months or so, the demand has really fallen off for domestic equipment and some makers are operating at only 30 per cent of capacity. Several builders have fared so badly financially that they have just about taken the "open for business" shingle off the door. This industry, which produces lathes and grinding, drilling, gear cutting, milling, shaping and boring machines, sees no relief in sight during the next six months or more. Only a few of the Australian companies are operating at full capacity and the top backlog for any one company in the industry is only nine months. However, most of the makers are living hand-to-mouth with orders coming infrequently. The builders have little or no inventory of finished products so standard machines can't be bought off-the-shelf.

Optical Grinding

Sales for optical grinding machines are expected to run about $7 million for 1956, according to industry executives. This, we think, is particularly noteworthy since only a few years ago, 1952 to be specific, sales amounted to only $150,000. Last year the industry sold about $5 million worth of equipment.

2000th Red Ring Rotary Gear Shaver Delivered

Walter S. Praeg, president of National Broach and Machine Co., Detroit, tells us that the company just delivered to Marvel-Schebler Products Div. of Borg-Warner Corp. the 2000th Red Ring rotary gear shaver produced by National Broach. This hall mark machine is a GCU fully automatic type equipped with an automatic loader and capable of finishing the teeth on a one-inch diameter automatic transmission helical gear to 0.0001 in. tolerances in 16 sec. The first Red Ring rotary was built in 1934 and put in operation by Chevrolet to finish spur gears at a one-a-minute rate.

Joined Hands

Brown & Sharpe Mfg. Co., of Providence and Nelco Tool Co., Inc., of Manchester, Conn., have combined sales operations. Manufacturers may now contact any Brown & Sharpe-Nelco distributor and order more than 2300 Brown & Sharpe high speed steel metal cutting tools or over 700 Nelco carbide and carbide tipped tools. Stocks will be maintained at every metalworking center assuring "milk route" delivery of the standard tools.

Readers of
AUTOMOTIVE INDUSTRIES
are always well informed

• • •

General Presents Premium Tire With Numerous Safety Features

Dual treads providing two separate points of contact at the road and higher carcass strength are the principal features of a new premium safety tire introduced by General Tire and Rubber Co.

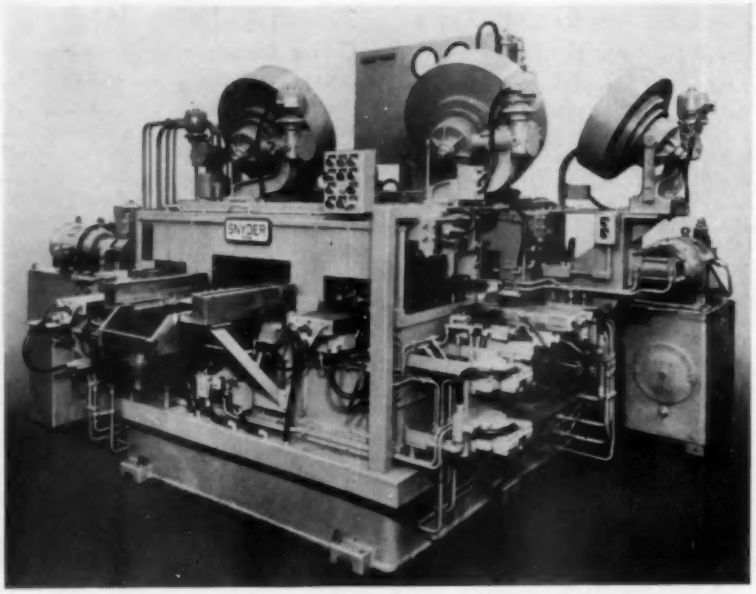
Called the Dual 90, the new tire has two distinct treads separated by a circumferential groove which provides greater stability by making the tire more flexible to the center. The dual treads work independently for better road contact and improved rolling action.

Since the treads are free to flex separately, there are two distinct radii instead of one. This feature is said to permit more tread surface to be constantly flat on the road.

In addition to the improvement in tread design, the tire also features a new method of stabilizing the puncture sealant inside the casing by confining it between two membranes of high strength rubber. Greater safety also is provided through use of three-ply nylon cord processed chemically to add 50 per cent more strength.

NEW PRODUCTION and PLANT EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89



Snyder automatic assembly machine applies sealer, presses in three welch plugs, and air tests right- and left-hand cylinder heads at the rate of 130 per hour.

Assembly Machine Processes Cylinder Heads

AN automatic assembly machine that applies sealer material and assembles three welch plugs in engine cylinder heads, air tests the finished assemblies, and automatically rejects from the machine any heads that do not meet the test standards, has been developed. The seven-station, in-line transfer machine is loaded from a conveyor. In automatic sequence, the machine applies sealing compound to three holes in the head, presses in three welch plugs, air tests the assembly for leaks and rejects faulty heads from the line, and unloads the head and plug assembly on a conveyor line.

Another unusual feature of the machine, which assembles 130 heads per hour at 80 per cent efficiency, is that it makes right and left-hand cylinder heads by alternately pressing plugs into opposite ends of the heads as they pass through the machine.

Welch plugs are fed to the machine from individual hopper feeds that deposit one plug at a time in front of hydraulic-powered plungers that press them into the heads. Maximum-stroke switches on each plunger govern the machine cycle in such a manner that parts will not be transferred if any plug is not pressed-in to depth. *Snyder Tool & Engineering Co.*

Circle 30 on postcard for more data

Power Feed for Drill

NOW available is an infinitely variable power feed, with a range of ½ ipm to 6 ipm, which has been designed to improve the quality of work and permit large hole drilling on hand-operated Burgmaster turret drills Models 2A, 2B and 2BR (radial). It can be ordered on new equipment or may be installed on machines in the field.

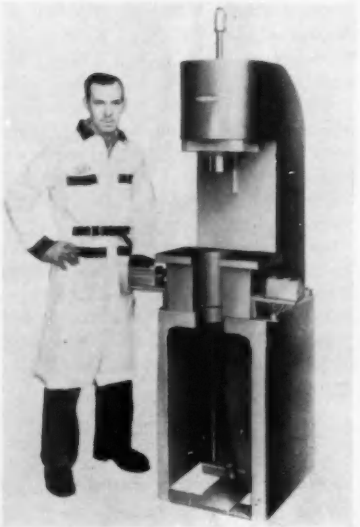
To operate, the tool is brought to the work with feed wheel and starter button is then pressed to engage the feed. Engagement is effected through an electric clutch which disengages automatically when the depth stop screw for a particular spindle contacts the depth stop bar. Feed is varied, either before engagement of the clutch or while the cutting tool is in the work, by turning a knob which varies the rate of feed according to a graduated scale. The unit has power to drive a ¾ in. drill in mild steel at good production rates.

The infinitely variable feature makes it possible to do single point boring on short runs where sizing tools are not available. It is also said to assure excellent finishes due to the constant rate of feed, as well as maintaining tolerances.

Operator fatigue is decreased since the effort of pulling large tools through the work is taken up by the power feed. The unit is compact, consisting of a control panel, feed engagement switch, depth stop bar and the power feed handle assembly. *Burg Tool Manufacturing Co., Inc.*

Circle 31 on postcard for more data

Air-Hydraulic Press



This Model C-500 air-hydraulic press, with a rated capacity of 15 tons, was recently introduced. The standard unit has an 8¼-in. throat and delivers a 6-in. stroke at 10 cpm. Other throat and stroke sizes are available. Three types of controls are offered—dual hand, foot pedal and fully automatic. (Air-Hydraulics, Inc.)

Circle 32 on postcard for more data

Machine Bores Differential Housing Flanges Simultaneously

THE Model S Bore-Matic does borizing on both ends of a differential housing, and while operations are done simultaneously 50-in. apart, tolerances and concentricity are held to close limits. The surfaces borized are bearing and oil seal diameters and adjacent chamfers. With 0.015-in. stock removal, diameters are held to a tolerance of 0.002-in. Production based upon 70 per cent efficiency is 36 housings per hour.

The workpiece, over four feet long, is held between two angle plate fixtures and is stabilized at its mid-section by a horizontal platen. The left-hand angle plate is secured to the base. The movable right-hand angle plate is hydraulically actuated, clamping the workpiece flange faces. Locating holes in the flange face receive round and two-way locating pins.

A feature of this machine is the use of feed-out tools to eliminate tool drag line or spiral normally present in one-way boring operation. Air-operated pushrods working through hollow boringhead spindles advance the tools to the correct position for in-boring, and retract the tools prior to table run-out, eliminating the necessity of boring out to avoid drag line.

A hydraulic unit mounted at the rear of the machine provides all power for the horizontally-opposed slide units which carry the tooling to the workpiece. Except for loading operations, all machine functions are controlled from pushbutton station. *Heald Machine Co.*

Circle 33 on postcard for more data

Heald Model S Bore-Matic machines both ends of workpiece with one clamping.

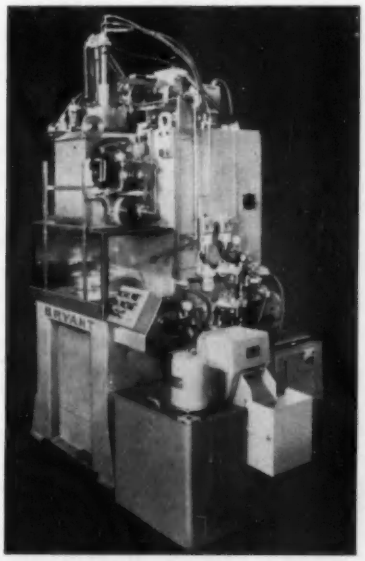
Vertical Cam Grinder

THE introduction of a special vertical version of the "Centalign" automatic internal grinding machine has been announced. This new machine, a vertical cam grinder, features rigidity and stability; faster stock removal; and workhead, wheelhead and longitudinal and cross slide motions of the wheelside in one common plane to reduce deflections and insure permanent alignment.

Machine function is controlled by programming cam sets which can be interchanged. A simplified hydraulic servo-control system is said to combine the advantages of both cam and hydraulic machine operation and to give accurate machine control and smooth responsive operation.

Typical of the uses of the machine is the grinding of two-lobed bores in hydraulic pump parts at the rate of 130-140 pieces per hour. This reportedly compares with a production rate of 30 pieces per hour obtained by previous methods. Work parts are hand-loaded into a special chuck, rotating at 100 rpm. This increased rotation rate is said to be one of the reasons for the vertical Centalign's greater production capacity. Stock removal is 0.015 to 0.020 in. *Bryant Chucking Grinder Co.*

Circle 34 on postcard for more data



Vertical version of Bryant Centalign automatic grinder, with guards removed

Integral-Motor Pumps

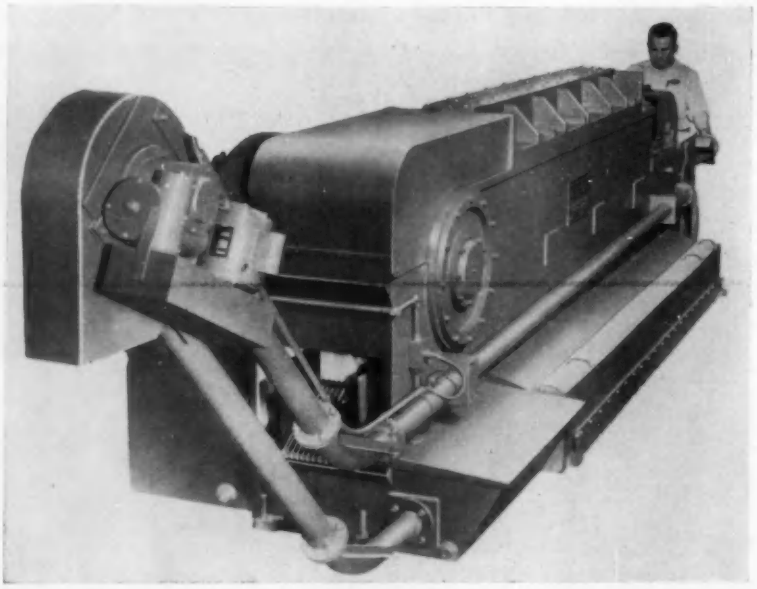
THREE new rotary air pumps of integral-motor design offer average weight reductions of one-third over former models, according to an announcement. Details include mounting of the rotor directly on the shaft of new type G. E. Form G motor. Some of the dimensions are also reduced, giving a more streamlined, compact appearance. In addition to plant uses, all models are said to be suitable as equipment on automatic machines, industrial instruments and controls, and as portable laboratory air sources.

The Model 0211 delivers up to 1.3 cfm of free air at 1750 rpm with vacuum to 27 in. or pressure to 25 psi.

The Model 0321 delivers up to 2.2 cfm with ¼ hp motor. Vacuum is produced to 28 in., pressure to 25 psi.

The Model 0521, a completely new addition to the line, is very similar in appearance and weight to the 0321, and delivers an air volume to 3.8 cfm with 1/3 hp. Both larger models include forced air fan cooling for continuous service at moderate temperatures. *Gast Manufacturing Corp.*

Circle 35 on postcard for more data



View of Detroit continuous horizontal broaching machine from unloading end. Unloading is done automatically by gravity, after automatic hammer lock releases fixtures.

Continuous Horizontal Broaching Machine

FIXTURE locking, operation and unloading are fully automatic with a new heavy duty horizontal continuous broaching machine recently announced. Provision can also be made for automatic loading of the machine.

Longer broach life and extremely fine finishes are said to be made possible because of the heavy, rigid construction of the machine. The frame is of all-welded, heavy steel plate construction. A large bull gear provides the pulling power, weight and smooth operation required for fine finishes. Loading and unloading of a variety of work sizes and shapes is made possible by the extra fixture clearance formed by the large radius from the chain axis to the outer machine frame. A safety interlock device prevents operation until parts are positively positioned in the fixtures.

Cutting speeds up to 40 fpm can be obtained from the twin chain electric-mechanical drive. Other speeds can be obtained through change gears. Fixtures are the hammer lock type, automatically located, locked, opened and emptied. The number of fixtures can be varied to meet production requirements.

The machine is self-contained, including the filtered coolant tank, pumps and automatic chip disposal unit, which is an endless convevor. The model illustrated has a 90-in. stroke with 15 tons capacity, and is approximately 60 in. high by 70 in. wide by 207 in. long, plus chip conveyor overhang. Other 15-ton models are being built with 66-in. stroke and 120-in. stroke, while lower and higher tonnage capacities are also available. *Detroit Broach Co.*

Circle 36 on postcard for more data

Portable Cooler

INTENDED for applications in processing, laboratory work, and instrumentation, a forced flow circulating cooler is fully portable. The mechanically refrigerated unit is equipped with stainless steel heat exchange tank, corrosion-resisting pump and sensitive thermostat control to govern the temperature of the circulating coolant. The control is said to maintain the coolant temperature within ±½ deg within a range of 25 to 80 F.

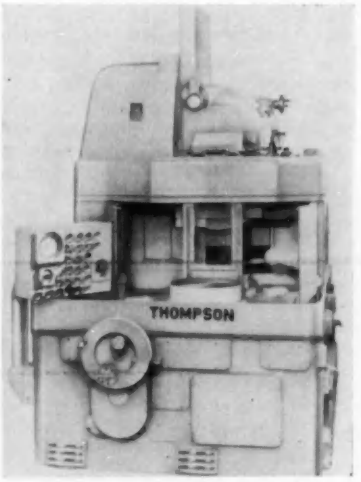
Requiring no plumbing connections, the unit will circulate a coolant through condensers, baths, heat exchange jackets, cold fingers, distillation traps or other devices. It will handle water, oil or other liquids and can be built specially for applications involving corrosive fluids or extremely close temperature control. Pump capacity is approximately 360 gpm at two-foot head. Units are also available with heaters to yield elevated or depressed temperatures under thermostatic control. *A. Daigger & Co.*

Circle 37 on postcard for more data

Circular Grinders

THE completion of a new line of twin rotary circular grinders, available in six sizes with table work surfaces from 6 to 24 in., has been revealed. Cycle time with the Type TR series is said to be reduced 40 per cent because the operator loads one magnetic chuck at the front position while another part is being ground automatically in the rear position. Typical job applications include automotive gear clusters, aircraft turbojet blades, and automotive gear faces. One gear cluster, of SAE 5135, is being finish ground with stock removal of 0.008 to 0.010 in., a tolerance of ±0.0015 in. and finish of 25 microinches.

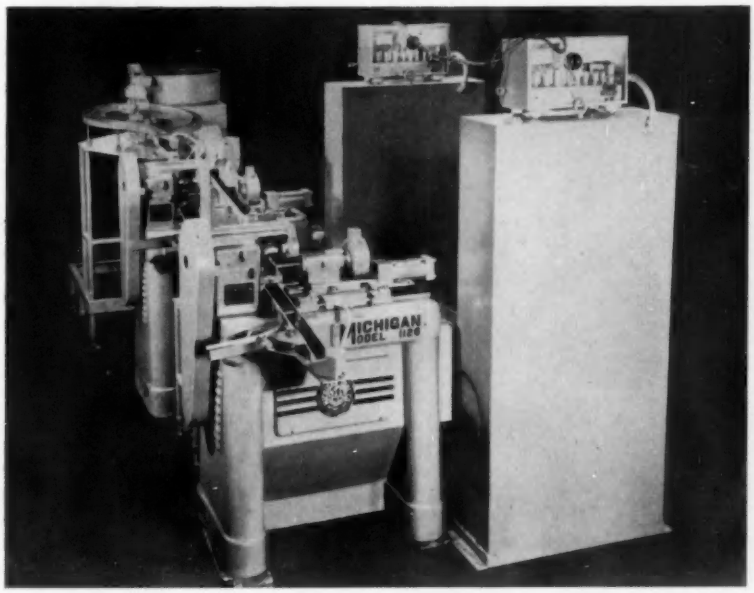
The automatic machine cycle is as follows: Operator starts machine cycle by pressing cycle start button. Wheel head moves downward contacting the workpiece, removing a predetermined amount of stock. Then spark out cycle occurs. Wheel head returns to up position, operator unloads ground parts and grind cycle starts automatically in rear position.



Thompson TR-12 twin rotary grinder

Features of the grinders include horizontal wheelhead grinding with 14 or 20 in. diam wheel to controlled size with automatic compensation of the feed screw; automatic wheel truing and spark out; and variable speed work table drive. A separate coolant system is standard, with extra large tank and prelubricated ball bearing type centrifugal pump available as an extra. Automatic gaging equipment can also be furnished. *Thompson Grinder Co.*

Circle 38 on postcard for more data



Michigan Tool Model 1126 speeder automatically audio tests gears.

Speeders Audio Test Gears Electronically

SOUND testing of transmission gears, with the entire operation including the feeding of parts from a storage hopper, clamping and speeding of the gear and either selective rejection for excess noise in any frequency band or passing through of the gear all being done automatically, is now possible with gear speeders designated Model 1126.

Spur or helical gears, either single or in a cluster, can reportedly be audio tested to exact specifications. The electronic panels can be set up to reject gears for undesirable noise levels of high, low or intermediate frequency at particular speeds within the working range of the gear. Dependence upon an operator's sense of hearing and judgment is thus eliminated, particularly in marginal cases. In addition, the time required to speed test marginal gears is said to be materially reduced since the control unit doesn't question whether the noise level merits rejection the way a human operator often has to do. If the noise level exceeds the prescribed amount, rejection is positive and quick.

The speeders can be set up in line to check two automotive pinions as shown in the illustration. Since the face widths of both pinions are not the same, an orienter is used to assure that workpieces after leaving the storage hopper come to the test stations in the right order. The first speeder sound tests the first gear in the cluster and the second speeder tests the second gear. The gear is rejected at either sound tester if the audio range is undesirable. *Michigan Tool Co.*

Circle 39 on postcard for more data

Mill for Powdered Metal

THE development of a powdered metal rolling mill for rolling metal powders into strip was recently announced. Designated Model FH-400, the machine has six-inch diam by six-inch face width chrome-vanadium alloy steel cold rolls, arranged horizontally, which turn on cage-type needle roller bearings. Each roll neck bearing has a load capacity of 25,000 lb equal to a maximum roll separating force capacity of 50,000 lb. An additional set of chrome-moly-tungsten alloy steel hot rolls can also be furnished if the mill application calls for work at elevated temperatures. To obtain internal heating, the hot rolls may be fitted with cartridge elements, including slip rings and brushes to feed electric current to the cartridges, which heat the rolls.

Roll adjustment is made by means of a single handwheel, worm gear screwdown provided with lifting studs which permit control of the roll setting in either direction. A graduated dial provides micrometer adjustment of the roll setting, and a clutch is povided to aid in establishing roll parallelism. The machine base and roll housing mounting plate have provision to permit material to pass beneath the rolls and through an independently installed sintering furnace. Close control of resulting strip widths is said to be obtained by a set of precisely machined stainless steel side guides.

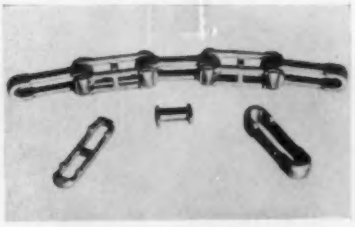
The unit is powered by a five horsepower, brake-equipped four-speed gearshift drive to operate at speeds of 10/20/30/40 rpm and is controlled by forward and reversing magnetic starters actuated by remote control pushbutton stations mounted on both sides of the mill base.

It is stated that in recent performance tests, the unit successfully produced strip from such powders as copper, brass, nickel, nickel-silver, aluminum, molybdenum, tantalum, stainless steel and other ferrous alloys. *Stanat Manufacturing Co., Inc.*

Circle 40 on postcard for more data

Rivetless Chain

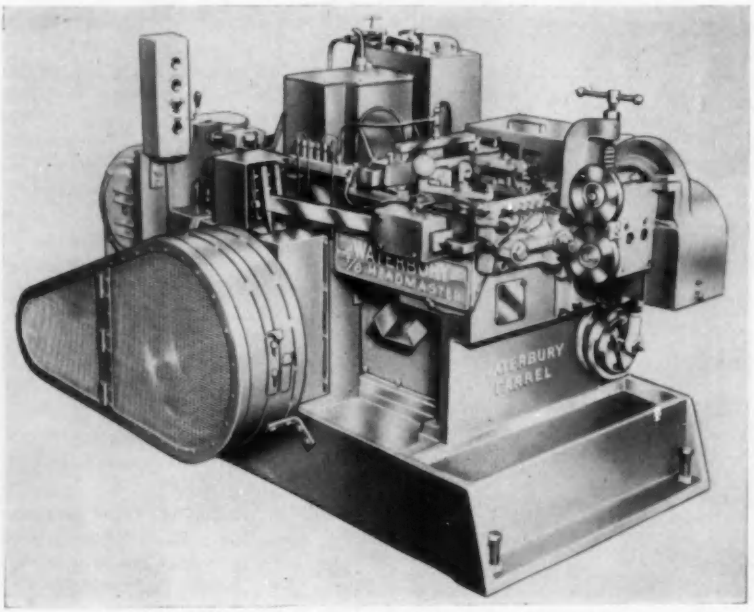
RIVETLESS forged chain for heavy conveying operations, tested for a breaking strength in tension of over 200,000 lb, is now available. It weighs 16 lb per foot. Precision machined links and coin pressed pintles are said to assure full, uniform bearing, easy assembly and disassembly. The design permits flexing laterally as well as around



Transue & Williams rivetless chain for heavy conveying operations

sprockets, so the chain travels freely on a close radius curve. Standard material is forging quality steel, heat treated; the chain can also be furnished in special heat- and acid-resisting metals. Four smaller sizes of the design are also available. *Transue & Williams Steel Forging Corp.*

Circle 41 on postcard for more data



Waterbury Farrel solid die, double stroke cold heading machine

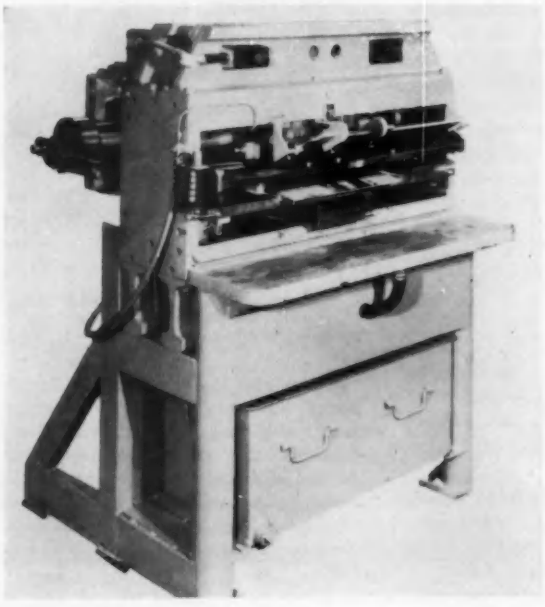
Solid Die, Double Stroke Header

NAMED the "Headmaster," a new solid die, double stroke cold heading machine has production rates ranging from 300 to 450 screw or rivet blanks per minute. It will head rivets up to ⅛ by ⅜, machine screws up to No. 6 by ¾ and sheet metal screws up to No. 8 by ¾. It can be equipped with either standard or Phillips type tooling.

The toggle actuated gate mechanism provides two blows, one long stroke and one short stroke, for each flywheel revolution. The gate advances rapidly and then decelerates on contact with the blank, producing a squeezing action rather than an abrupt blow. *Waterbury Farrel Foundry & Machine Co.*

Circle 42 on postcard for more data

Machine Automatically Knurls Motor Shafts



The Morley Model 101 shaft knurling machine illustrated produces spline type knurls on small electric motor shafts. It will make a knurl up to three inches long on shafts up to 20-in. long and up to 5/8-in. diam. The shafts are hand-fed from a magazine; and automatically roll out into a receiving tray after being knurled. A coolant system is built into the machine. Rate of production is approximately 3000 shafts per hour. (Morley Machinery Corp.)

Circle 43 on postcard for more data

Pickling Bath Additive

DEVELOPED for use as a rust preventive and corrosion inhibitor for steel, a wetting agent and emulsifier is also said to be effective as an acid fume depressant in the pickling bath. The new product is called Akweons #674 and is designed to be added to any sulfuric, hydrochloric or phosphoric acid pickling bath solution. It is reported to be readily soluble in acid, alkaline or neutral solutions as well.

Originally designed as a rust preventive and as a retardant to acid attack on the base metal during the steel pickling process, the wetting agent has shown good results in helping to suppress fumes during the process, say company officials. It is ordinarily added in small quantities directly to the pickle solution, as well as to the scrubber acid. *Swift & Co.*

Circle 44 on postcard for more data

Precision Gage Blocks

A NEW grade of gage bocks, designated "AAA" and based upon new dimensional standards, is made to a tolerance of plus or minus one millionth of an inch per inch of length. This greater accuracy has been achieved, it is said, by the perfection of a process that produces an ultra fine optical surface finish of 0.09 microinch RMS. The blocks are conditioned in the gage laboratory for one year to assure stability, and in addition to being checked against grand master gages calibrated by the National Bureau of Standards, are checked against light waves by interferometry. They are available in square or rectangular blocks in sets of 86 pieces.

Grade "AA" gage blocks offered by the company, with a tolerance of plus or minus two millionths of an inch, are stated to have been taken out of the "laboratory" priced category so that they can be put to use for routine inspection work.

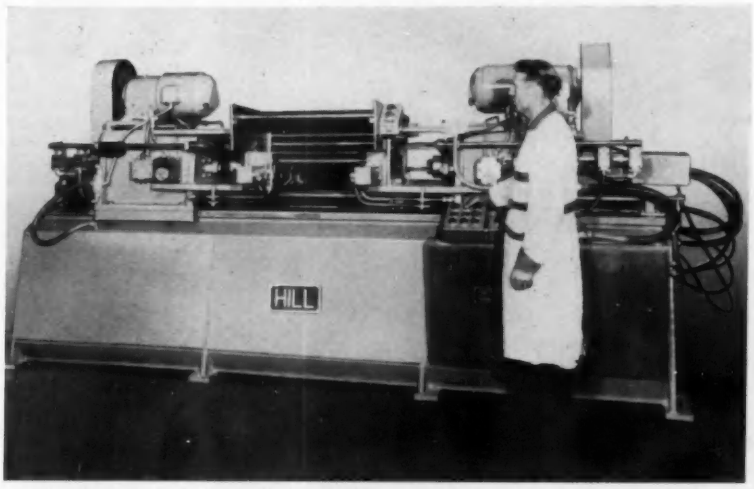
The company's "A" grade blocks now have a tolerance two-millionths closer on the minus side than that required by the National Bureau of Standards. This is said to provide a wear cushion of two-millionths for longer block life, besides the benefit of greater accuracy. The "A" grade blocks are being offered in place of "B" grade, which has been discontinued by the company. *The DoAll Co.*

Circle 45 on postcard for more data

Double-End Machines Perform Metal Forming and Removing Operations

AUTOMATIC double-end machines that perform either press forming or metal removing operations on both ends of rod or tubular parts from 1-ft to 24-ft long and up to six inch diameter are now available in a new line. They have hydraulic-operated automatic magazine feeds and two hydraulic-powered motorized heads that can each develop up to 20 tons of thrust force. Production rates range from 300 to 5000 pieces per hour depending on the part size and operations performed.

Without the motorized heads turning, parts can be fed through the magazine feed in conjunction with a length adjustment feature. Thus the machine can be operated like a forming press that will expand, reduce, flare or bead both ends of the parts simultaneously. With the motorized heads turning, parts can also be fed with the magazine feed in conjunction with the length adjustment feature. In this arrangement, the machine will burr, chamfer, face, spin, drill, precision-bore or ream both ends of the parts simultaneously. These operations can be combined with forming and finishing operations if desired. The heads are individually controlled and have individual feed and stroke adjustments, enabling different types of operations to be performed on each end of the parts. It is possible to form one end of a part while the other end is being machined.



Hill double-end machine will do metal forming and/or metal removing operations on both ends of rod or tubular parts.

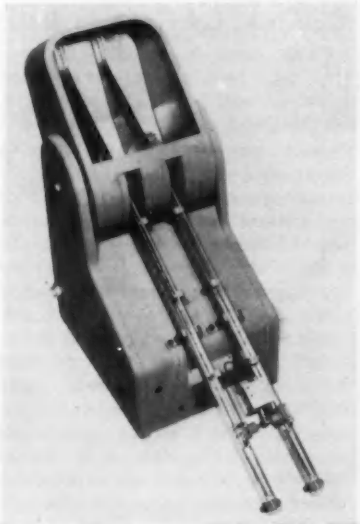
The particular machine model illustrated bores, faces and chamfers both the ID and OD on each end of a 30-in. long, two-inch diameter tubular SAE 1010 steel steering column at the rate of 950 pieces per hour with combination tools in each head. The steering columns are fed one at a time into the hydraulic-operated clamp jaws from the magazine feed that is kept full by the operator. With the part clamped, the motorized head quills are automatically positioned axially to allow for length variations in the part. Then the quill is fed to depth, retracted and the part ejected onto a hydraulic cylinder operated unloader, and another part is positioned in the clamps for machining. *Walter P. Hill, Inc.*

Circle 46 on postcard for more data

Small Parts Feeder

AUTOMATIC feeding of small production parts has been improved with a new sliding action hopper feeder called the "Hopperal," according to an announcement. Using an oscillating motion, it is said to work fast and efficiently with a minimum of tumbling of the parts. The parts feeder selectively arranges bolts, nuts, screws, rivets and other types of small fasteners and parts on an internal track, permitting them to file out in an orderly manner to the outside feed track and down to any required position. A selector gate rejects pieces not properly positioned, allowing only those correctly positioned to flow to the feed track outside the hopper. Firmly supported by the hopper base, this track is rigid enough for lengthy extensions to the work operation.

The feeder can be equipped with single or multiple tracks. It can be designed to feed two different parts from the same hopper, and to release a given number of pieces at a controlled rate of speed. Its versatility permits adaptation to standard machines or integration with specialized ones. Completely self-powered, it becomes an independent assembly unit with the addition of accessory components. The tracks can be replaced with others to feed different items. Applications include assembly, inspection, gaging, packaging, processing, grinding, sorting and production loading. *Haberstump-Harris, Inc.*



Hopperal small parts feeder

Circle 47 on postcard for more data

Burnishing Compound

INTRODUCED for brightening the finish of zinc die castings, a new alkaline liquid burnishing compound called SM 186 may be used for self-tumbling or with shot or synthetic media. Recommended concentration of the solution is one to two per cent by volume.

Its use is said to produce a brighter finish and to improve the color of zinc die castings. It is also recommended for burnishing steel and copper. *Oakite Products, Inc.*

Circle 48 on postcard for more data

NEW PRODUCTION and PLANT EQUIPMENT

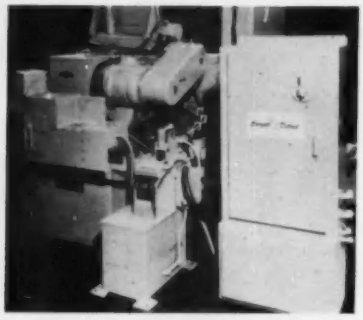
Double Crank Automatic Dieing Machines

Designated the S-2 series, a new line of automatic double crank dieing machines for progressive die stamping is designed to produce large-size metal stampings requiring large bed areas but not necessarily heavy tonnage capacities. In these double crank machines, pressure is applied by two crankshaft connections located in the base, which is said to provide a more even distribution of force over a longer bed area. The machine shown in the illustration has a rated capacity near the bottom of the stroke of 150 tons. (Henry & Wright)

Circle 49 on postcard for more data

Automatic Size Control

INCREASED accuracy in stock removal operations is said to be achieved with a continuous proportional automatic size control recently announced. In the application illustrated a centerless rough grinding operation is performed on a bearing race OD. With an average stock removal of 0.010-in., the part size is held within ±0.002-in. The control measures every piece and the setting of the operating machine—in this case, the wheel position—is influenced by the size deviation of each part, so that the adjustments are continuous.



Cargill automatic size control

Basically, the control consists of a transducer gaging head, amplifier, and servo-driven transmission. As illustrated, parts coming from the machine are fed through the gaging head by an auxiliary feed mechanism. For multiple machine through-feed applications, the gage head is mounted in line on the parts conveyor. An optional size sorting mechanism directs the sized parts to different chutes. *Cargill Detroit Corp.*

Circle 50 on postcard for more data

Cooling, Lubricating Unit

METAL machining time is cut up to 75 per cent, it is claimed, by a new industrial cooling and lubricating system designed for tool room and single-point metal cutting and stamping operations. Named Liquidaire, the system operates on the principle of mist cooling. The coolant is pressurized and forced through a nozzle, and as the fluid is ejected it flows over the outside of the nozzle's liquid control needle. Through the center of this needle a jet of high velocity air is discharged, penetrating the liquid from the inside. This action produces liquid suspension in the air under control of the ejector, and as the pressurized mist coolant expands and strikes the cutting tool and material being worked, the heat caused by the tooling operation is said to be transferred to the vapor and evaporated into the atmosphere. At the same time the lubricating properties of the coolant remain on the tooling to form a film over the cutting surfaces.

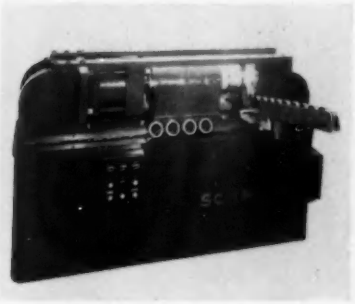
Complete units are now available in one, three and six gallon sizes. All models feature single or dual controls for both liquid and air. These units or custom models can be applied to single point cutting operations, or simultaneous multiple machining on a battery of tools using a centralized reservoir tank. In the latter case the system can be controlled from one central location or at each machine. *Frisch Corp.*

Circle 51 on postcard for more data

Marker for Bearings

DESIGNED specifically for marking the faces of bearing races in production, a new marking machine has a flexible capacity, being equipped with adjustable feed and discharge chutes, and throat adjustment to accommodate bearings from 15/16 in. to 3⅜ in. diam and thicknesses of ½ in to 1⅜ in. Feed spiders are available to fit each diameter of bearing to be marked.

The machine is operated by a remote hydraulic unit which consists of a 12 gpm pump, 60-gal tank and a 10-hp motor. The unit develops a pressure of 30 tons which will re-



Schmidt Model 385 marking machine

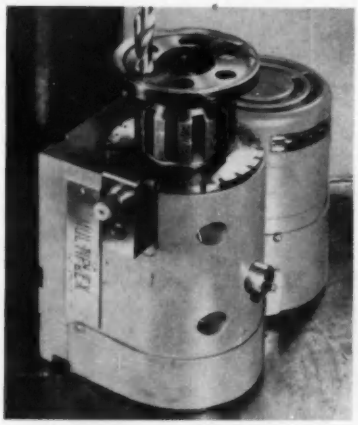
portedly sink lettering dies engraved 0.025 in. deep to the background of the characters. This is said to provide ample depth for grind on face.

The bearings may be fed directly from the turret lathe to marking chute, and after marking they roll to the opposite side of machine into discharge chutes. The cycle is automatic. A variable drive provides marking capacity from 1250 to 1680 bearings per hour. *Geo. T. Schmidt, Inc.*

Circle 52 on postcard for more data

Indexing Head

DESIGNED for various applications, a motor-driven rotary indexing head employs a 24-step plate and stop pin for positioning. Work can be positioned on a grinding machine table and rotated by the motor drive; or can be indexed manually for milling, drilling and boring operations.



Multiplex motorized indexing head

The head is equipped with collets ranging from ¼ to 1 in., and with an interchangeable four-inch, three-jaw chuck. The motor rotates the spindle at about 250 rpm. Motor and spindle are assembled on a common base for application either vertically or horizontally. The motor is belt-connected. *Multiplex Co.*

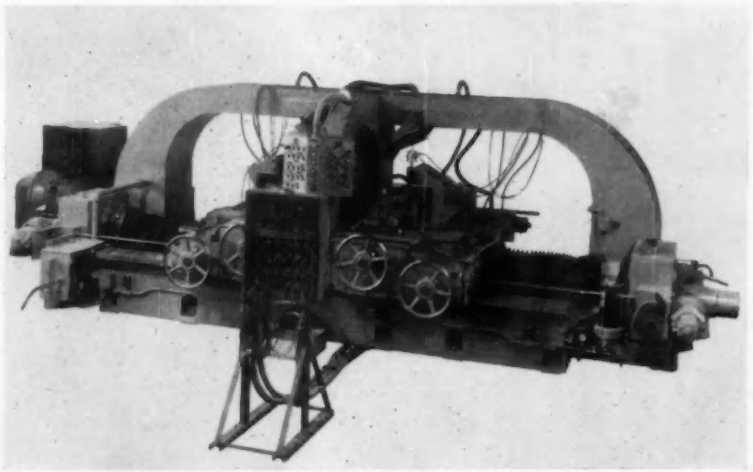
Circle 53 on postcard for more data

Magnetic Switch

OPERATING on the "proximity" principle, a new switch, in monitoring an assembly-line sequence of parts containing metal, "confirms" each piece as it comes along and trips a remotely-located relay so the part can move on to the next station; or conversely, shuts down the line if there is a break in the parade of pieces the switch is checking off. With no physical contact with the workpiece required, detection is accomplished by the object's passing through a magnetic field set up directly in front of the switch's sensing end. A signal flows through the magnetic circuitry of the switch and operates a remotely-located electrical control relay. This relay can be triggered up to 10 times per second.

The new switch is about six inches long and 1⅝-in. square, and is sheathed in a steel housing. The magnetic circuitry is embedded in a solid plastic solution. The sensing poles in the switch are designed to detect metal objects within ⅛-in. of its face. In the case of machine tool operations, it is said the switch cannot be set off by falling metal chips. Operation is on 115-v, 60-cycle current. *Minneapolis-Honeywell Regulator Co.*

Circle 55 on postcard for more data



Center-Drive Facing Lathe for Thin Sections

This double-end, center drive lathe profile faces various sizes of turbojet compressor disks up to 44-in. OD. Both sides of the workpiece are machined simultaneously. In cutting, the tools are held "together" directly opposed to each other within a few thousandths inch; accomplished, in one instance, by an electronic system combined with a mechanical differential actuating potentiometers. The potentiometer arrangement, in turn, relays a message to either feed motor for maintaining balance. Spindle speed control for constant surface speed at any pick-off diam through the cut is achieved with a variable speed drive unit and a rheostat, cam controlled. A test application entailed roughing, semi-finishing and finishing passes on a part having a thickness of 0.029-in. through 22-in. diam. Parallelism was within 0.001-in. Parts have since been taken to 0.007-in. thickness. Six sizes of the machine are available, ranging from 24-in. or 1¼-in. to 36-in. or 18-in. longitudinal travel either way from centerline. (Wickes Machine Tool Div.)

Circle 54 on postcard for more data

Remote Alarm System

A NEW automatic local or remote alarm system, offering both visible and audible warning for equipment failure or overload, and for hazardous conditions or intrusion, has been announced. It is said to be particularly adaptable to automated production lines or equipment, and work or storage areas not under continual observation.

The system works over a two-wire pair or single wire and ground return, or over conventional plant communication circuits. It produces a blast audible for more than 2500 ft. Any condition that will operate a switch or relay will trigger the alarm. Where the user has sensing devices already installed in strategic areas, these may be tied into the alarm system. Standard sensing devices are also available. *Sparton Control Systems Div., The Sparks-Withington Co.*

Circle 56 on postcard for more data

Load Cycle Counter

COUNTING only work or operations actually performed, a new telemetering load cycle counter differentiates between idling, dry run and load cycle. It is actuated by sensing the current flow to electrically-driven machines such as presses, broaches, drills and mills, or tempering, welding and other electrically-powered operations.

It is adaptable for proximity or impact counting. It can also be used as a warning and/or counting instrument for material change characteristics, dull tools, etc. The telemetering feature permits simultaneous counting at the machine and at a remote location such as a control center. The unit is available with six-digit counter; speed is up to 1000 counts per minute. *Ram Meter, Inc.*

Circle 57 on postcard for more data

Anaconda specifies Enjay Butyl rubber

TO DEFY OZONE IN HIGH-VOLTAGE CABLES...

for more current per circuit... more power per dollar

Anaconda specifies Enjay Butyl insulation for high-voltage cables because this rubber has incredible resistance to ozone. Surpassing the industry's standard three-hour specification test, Enjay Butyl insulation used by Anaconda showed *no injury after 72 hours* of ozone concentration tests—24 times longer than specification requirements. Other rubbers would deteriorate and crack in a fraction of this time.

With the help of Enjay Butyl, millions of feet of Anaconda's cable now in use deliver more current per circuit, more power per dollar.

Perhaps *your* product, too, can be improved with versatile Enjay Butyl. It comes in non-staining grades for white and light-colored parts, offers excellent electrical properties, low price and *immediate availability*. For full information, contact the Enjay Company. Complete laboratory facilities and technical assistance are at your service.

ENJAY BUTYL

Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

ENJAY *Pioneer in Petrochemicals*

ENJAY COMPANY, INC., 15 West 51st Street, New York 19, N. Y.

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Free INFORMATION SERVICE

Use either of these postcards for Free Literature listed below, or for more information on New Production Equipment and New Products described in this issue.

USE THIS POSTCARD

FREE LITERATURE

Lubricant Additive 1

Bulletin Lu-8a, eight pages, explains how moly-sulfide functions in chassis grease and discusses its properties and applications. *Climax Molybdenum Co.*

Perforated Materials 2

Catalog 62, 128 pages, lists perforated materials in hundreds of standard patterns, and gives information as to hole size, centers and per cent of open area. *Harrington & King Perforating Co.*

Electric Clutches 3

Electro-magnetic clutches for machine tool application are described in four-page bulletin ECP-656. *I-T-E Circuit Breaker Co.*

Index Tables 4

Catalog 301, 24 pages, gives the load ratings and dimensions of more than 150 standard high-speed index tables, which include dial sizes ranging from 12 to 120 in., with from 4 to 36 stations. *Ferguson Machine & Tool Co.*

Welding Electrodes 5

A line of resistance welding products and accessories is covered in Catalog 56, 56 pages. Included are standard and special spot welding electrodes, seam welding electrode wheels, dies, back-up bars, shafts, and bushings. *Weldaloy Products Co.*

Air Gaging 6

Catalog 56D describes the Dimensionair direct-reading air gage and its available attachments. Typical applications are illustrated, including automatic gaging and machine control. *Federal Products Corp.*

Copper Tape 7

A chart that enables engineers to convert from conventional round copper wire to copper tape for use in wafer-type coils is being offered by *American Silver Co.*

Lathes, Shapers 8

Sixty-six models of screw-cutting and turret lathes, shapers and accessories are outlined in a 24-page catalog issued by *Logan Engineering Co.*

Underdrive Presses 9

A 32-page illustrated catalog presents the Series U single-, double-, and triple-action underdrive presses, ranging in capacity from 400 to 2000 tons and designed for volume production of large stampings. *Danly Machine Specialties, Inc.*

Snap-Action Switches 10

Micro Tips Digest, a 16-page booklet, contains 43 illustrated descriptions of snap-action switches being used in industrial and commercial applications. *Micro Switch Div., Minneapolis-Honeywell Regulator Co.*

(Please turn page)

VOID After Oct. 15, 1956 **8/15/56**

Circle code numbers below for Free Literature, New Plant Equipment, or New Product Information

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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
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Readers Service Dept.

Roller Chain 11

Precision roller chain and sprocket wheels are described in 148-page Book 2457. Included is application data on stock drives, drive chain, conveyor chains, wheels, casings and chain tighteners. *Link-Belt Co.*

Foundry Equipment 12

Bulletin 56, 32 pages, lists a complete line of sand handling, mold handling, mold-making equipment. Other standard foundry equipment covered includes flasks, jackets, upsets, aerators, turntables, plate feeders, elevators, and conveyors. *Newaygo Engineering Co.*

Brine Chillers 13

Low-temperature brine chillers designed to produce a constant source of brine to —120 F for production or test application purposes are listed in a four-page circular issued by *Murphy & Miller, Inc.*

Gearmotors 14

Bulletin 1880, 16 pages, features the latest design improvements in a line of gearmotors and lists ratings from ½ to 30 hp, with gear ratios as high as 10 to 1. *U. S. Electrical Motors, Inc.*

Structural Bonding 15

Information on structural bonding techniques, including technical data on high-temperature adhesives for metal-to-metal and sandwich applications in the aircraft industry, is furnished in a 20-page brochure made available by *Narmco Resins and Coatings Co.*

USE THIS POSTCARD

Extruded Products 16

Six-page folder, TB-413, covering extruded products, includes a description of facilities for producing tubular and solid shapes, and a list of the ferrous and non-ferrous alloys which have been successfully extruded into tubing, solids and shapes. *Tubular Products Div., Babcock & Wilcox Co.*

Welding Control 17

Bulletin 338 explains a predetermined, electronic counter welder control, which counts cycles of power line frequency to control welder sequence for producing consistent repetitive welds. *Sciaky Bros.*

Gray Iron 18

The application and physical properties of two grades of alloyed and two grades of unalloyed electric furnace iron are covered in Folder 15, four pages, published by *Belle City Malleable Iron Co.*

Nickel Tubing 19

Catalog 12, 20 pages, contains design data on nickel and nickel-alloy small-diameter precision tubing. *Superior Tube Co.*

Metallic Abrasives 20

Technical data on a line of metallic abrasives is presented in Catalog 556, 18 pages. Cleaning and peening methods are also included. *Cleveland Metal Abrasive Co.*

Welding Units 21

Bulletin 156, 12 pages, covers a line of resistance and arc welding equipment for semi-automatic and fully automatic operation and featuring specially designed work positioning fixtures. *Arco Welder Mfg. Co.*

Heavy Machines 22

"This is Farrel-Birmingham," a 44-page illustrated booklet, describes company facilities and features a wide variety of heavy machinery and machine tools. *Farrel-Birmingham Co., Inc.*

Aluminum Casting

Casting Kaiser Aluminum, a 388-page book, is a comprehensive treatment of all phases of aluminum casting, which includes a discussion of foundry practices and a complete analysis of aluminum casting alloys and their characteristics. Address request on company letterhead to *Technical Editor, Kaiser Aluminum and Chemical Sales, Inc., 919 North Michigan Ave., Chicago 11, Ill.*

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The Engineer from Continental Screw Co. ...

...offers you the world's largest selection of stainless steel fasteners

Continental can guarantee faster service because of its tremendous inventory

No matter what your stainless steel fastener needs may be, Continental is in a position to serve you—thanks to the world's largest inventory of stainless steel fasteners.

All types of fasteners are represented in our inventory—wood screws, tapping screws, machine screws . . . in slotted or Phillips heads. And Continental has a full selection of stainless steel nuts . . . with close thread limits up to 3B.

This large inventory is the key to Continental's reputation for fast, accurate service. Literally acres of fasteners are waiting for your call. And Continental's specially trained engineers are always ready to analyze your specific needs. Take advantage of Continental's more than 50 years' experience. Call today.

Only Continental Engineers Are Required To Have This Training

Each engineer at Continental is required to undergo thorough experience producing ground thread taps and gages, with their exacting screw thread dimensions. This special training is passed on to you—at no extra cost.

CONTINENTAL SCREW COMPANY INC. 1904

—You can count on Continental.

Continental Screw Co.

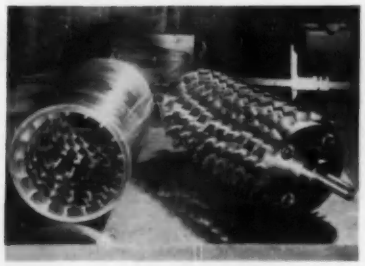
Manufacturers of Holtite Fastenings
New Bedford, Massachusetts, U.S.A.

NEW PRODUCTS AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89

Axial Flow Compressor

A new design of axial flow compressor has a rotor and stator composed of a series of interlocking blade rings and spacer rings as shown in the illustration. The annular air passage through the compressor is of constant cross-section; however, the



blade pitch varies with each stage. Non-surging operation is said to be attained by proper design of the cross-section of blades' leading edges.

In one application to supercharging a V-8 engine, the 11-stage compressor used is bolted to the center of the intake manifold, with two carburetors mounted at the front on the intake to the compressor, thus retaining negative pressure on the fuel feed. Driven with a flat belt from the crankshaft at 4½ times engine speed, a maximum of only 10-hp is stated to be consumed in giving a manifold pressure of eight pounds. *Latham Manufacturing Co.*

Circle 60 on postcard for more data

High Temperature Alloys

Two high temperature alloys for aircraft and industrial gas turbine applications were recently announced.

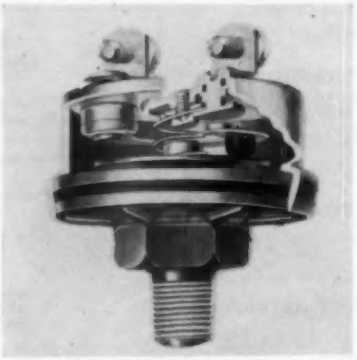
The first, Inconel "700" age-hardenable nickel-cobalt-chromium alloy, contains approximately 50 per cent nickel and 30 per cent cobalt. This new alloy was developed for designers who were seeking adequate strength for forged aircraft gas turbine blades at temperatures up to 1650 F.

The second new product, Incoloy "901" nickel-iron-chromium alloy, has been developed for use in aircraft and industrial gas turbines for components requiring high creep and rupture strength in the temperature range of 1000 to 1400 F. At these temperatures, the alloy has properties that compare favorably with those of the "super" alloys yet is low in strategic alloy content. An important physical property is its low co-efficient of thermal expansion. Containing approximately 40 per cent nickel, it is close enough to ferritic alloy steels to permit the two materials to be joined without special provision for thermal expansion. *International Nickel Company, Inc.*

Circle 61 on postcard for more data

Vacuum Switch

A heavy-duty vacuum switch, housed in a hermetically sealed dust-proof steel case, features a spring-loaded, Buna-N-impregnated, diaphragm. Operation, which is factory calibrated, opens and closes a contact at fixed vacuum values. Available for normal open or normal closed use at zero vacuum with settings up to 22 in., it is designed for use with 6-, 12-,

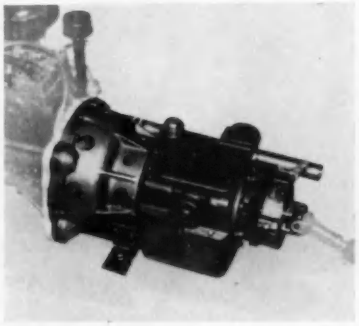


or 24-volt dc, but can be modified for low voltage ac. The unit is supplied in either single terminal grounded or double terminal models. Over-all measurements are: 1¾ in. wide; 2-1/16 in. from top of terminal to end of pipe thread. *Rochester Manufacturing Co.*

Circle 62 on postcard for more data

Planetary Transmission

Six new models of a planetary gear transmission, designed particularly for use on road building machinery, lift trucks and similar equipment, were recently announced. Called Plan-



Gear transmissions, introduction of these added models provides a complete line of seven units. Of the compound planetary type, the transmissions range from 85 or 150 lb ft to 200 lb ft torque output. They are provided with one or two forward speeds and a choice of reverse gear ratios. Bellhousings provided with some of the models enable them to be used with Borg & Beck torque converters, and Chrysler torque converters and engines.

Among the stated advantages of the new transmissions is simplicity of operation. By moving a single hydraulic control lever, the operator obtains practically instantaneous change of speed or direction. The elimination of clutch pedal reduces operator fatigue. *American Gear & Mfg. Co.*

Circle 63 on postcard for more data

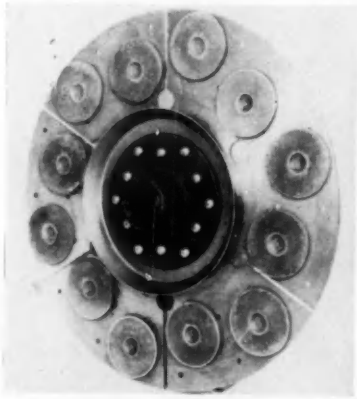
Teflon Hose

Teflon flexible hose assemblies for aircraft use are now being offered. Available in sizes —4 to —20, the assemblies have been tested to conditions in excess of MIL-5511 and those of airframe and engine manufacturers, the company reports. *The Weatherhead Co.*

Circle 64 on postcard for more data

Ceramic Clutch Linings

Clutch plates employing ceramic-type linings in place of conventional organic facings are now being manufactured for a line of heavy-duty clutches for off-highway vehicles. The new facings are said to have char-



acteristics of high resistance to heat and frictional wear that give them up to five times the life of ordinary facings.

The new ceramic friction material is compressed within shallow metal cups or "buttons," with six such buttons comprising the facing on each side of the plate for clutches up to 14-in., and 12 on each side for clutches 14-in. and over. The buttons are mounted back to back on either side of the clutch plate, with a single tubular rivet holding each pair in place. The rivet and the retaining cup wear down as the lining wears.

The compound used in these friction disks is composed of ceramic and metallic ingredients, and the facings are said to retain their high-friction characteristics even under extreme heat conditions. This reportedly makes it possible for the lining to provide a load capacity up to 50 per cent greater than that of a conventional facing. *Lipe-Rollway Corp.*

Circle 65 on postcard for more data

Liquid Fastener Lock

Locking nuts, bolts and screws by a simple chemical method is now possible by the use of a sealant trademarked Locktite, according to a recent announcement. This new liquid, with the appearance of kerosene, hardens in the joints betwen metal parts, sealing the joints and bonding the parts together. While said to provide a superior lock, treated nuts and bolts are removable with ordinary tools. Applications also include the locking of set screws, bonding of sleeve joints, and sealing of porous welds.

The sealant is a clear, thin liquid which hardends when confined between the surfaces of closely-fitting metal parts, to form a heat and oil-resistant plastic seal with a high shear strength. The catalytic action of the metal surfaces aided by the absence of air (which acts as a stabilizer) causes the hardening process. The material will remain liquid for months in the original container, and for days as a film on metal parts prior to assembly. After assembly, hardening takes place in about 24 hours. Since the sealant contains no volatile solvent, it hardens with little shrinkage.

Metal fasteners can be treated in large lots or individually. In the multiple application method, degreased fasteners are treated by briefly tumbling; and the sealant remains liquid until after the fasteners are used in an assembly. The material can be used on aluminum, steel, copper and brass parts. *American Sealants Co.*

Circle 66 on postcard for more data

Aluminum Wheel

The placing on the market of the first forged disk aluminum wheel for tubeless truck tires was recently revealed. Of one-piece leakproof construction, the new 22.5 by 7.50-in. wheel is said to retain the advantages of aluminum in a design offering compatibility with tubeless tires. Advantages cited include high thermal conductivity, easier steering, smoother riding, and lighter unsprung weight. *Aluminum Co. of America.*

Circle 67 on postcard for more data

Tire Rim Valve

A new single type rim valve has been introduced that places in discard 16 different valves previously required to do the job. Adaptable to any Goodyear tubeless highway rim, the two-inch long unit can be threaded into the rim wall of a disk wheel or adapted to any size of drop center tubeless truck and Tru-Seal over-the-road rims by varying the location of the valve hole. Used in this latter instance are two simple adapters, one of which is used on 5.25 to 6.00 rims, the other, longer adapter on 6.75 to 8.25 rims. *Metal Products Div., Goodyear Tire & Rubber Co.*

Circle 68 on postcard for more data

Trailer Axles

Non-driving, heavy-duty trailer axles with 18,000-lb and 20,000-lb load rating on tires and equipped with new style brakes, have been announced. Axle tubes for the new line, known as the ND-18000 and ND-20000 series, are of one-piece forged five-inch OD tubular steel. The M-C brake requires no slack adjusters or outboard bearing assemblies, which makes for a substantially lighter and more compact brake assembly and avoids air chamber mounting or outboard bearing lubrication problems, according to company engineers.

Both brake shoes, which are free-floating and self-centering, are fully energized in both forward and reverse. The unit is designed so that brake

actuation by air, oil, air over oil or vacuum can be installed by changing a simple assembly at one easily accessible location. Brake linings and shoes are removable for servicing without the need to disturb the actuators. Brakes can be adjusted with wheels on the ground. Linings will last longer and brakes will need less adjustment during the life of the lining, than is the case with conventional brakes, it is claimed. The axles can be equipped with either 15½ in. or 16½ in. brake drums, in 6 in. or 7 in. widths.

While Budd 10-stud, 11¼ in. bolt circle, hubs and drums are standard, the axle is designed to be used with all standard makes. Spindles and brake mounting are identical on both axle series. In addition, all currently manufactured trailer brakes are adaptable to these axles. Available in 71½ in. and 70¼ in. track widths, the axle tube can be furnished with air chamber brackets and outboard bearing bracket with Nylon outboard bearing kit, to trailer manufacturers who prefer to build up their own trailer axle assemblies. *Clark Equipment Co., Axle Div.*

Circle 69 on postcard for more data

News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Continued from Page 39

GM of Canada Turning Out New Heavy-Duty Truck Line

Expansion of Canadian industrial projects has created a demand for heavier trucks. General Motors of Canada, which until recently imported all trucks with more than 12-ton capacity, is now building five new truck lines ranging in weight from 12½ tons to 21½ tons.

The company retooled this spring for the heavier trucks and is now building them at the Oshawa, Ont., plant.

The new 550, W550, MW550 and 600 trucks are equipped with 324 V-8 engines, while the 630 and W630 models have 503 six-cylinder engines.

Survey Shows Many Buyers 'Shop' Before Selecting Car

A survey made by Dodge Div., which shows that more than two-thirds of the car buyers "shop around" before deciding on the final purchase of a car, is not surprising. Many dealers have been operating on small profit margins, and factories have been urging them to trim prices to achieve a fair volume in the current buyers' market. As a result, the dealer who gives the "best deal" is the one who often stands a better chance of getting the sale.

The Dodge survey shows that 69 per cent of Dodge buyers "considered" other makes before making the purchase. Whether that figure is indicative of a trend experienced by other car companies is open to question. It is conceivable that such a great percentage of buyers look for the best offers.

It is interesting to note in the survey that only slightly more than seven per cent of the new-car buyers sell their old cars themselves, rather than apply them as trade-ins on new models for one reason or another.

FERRARI 250 DRIVEN BY V-12 GASOLINE ENGINE

The Ferrari 250 car is powered by a 12-cylinder, V-12 engine with a bore of 2.85 in. and stroke of 2.29 in. Compression ratio is 8.5 to 1, and output is 220 bhp at 7000 rpm. The chassis is mounted on a wheelbase of 101 in., according to specifications.

Three More Executives Elevated at Chrysler

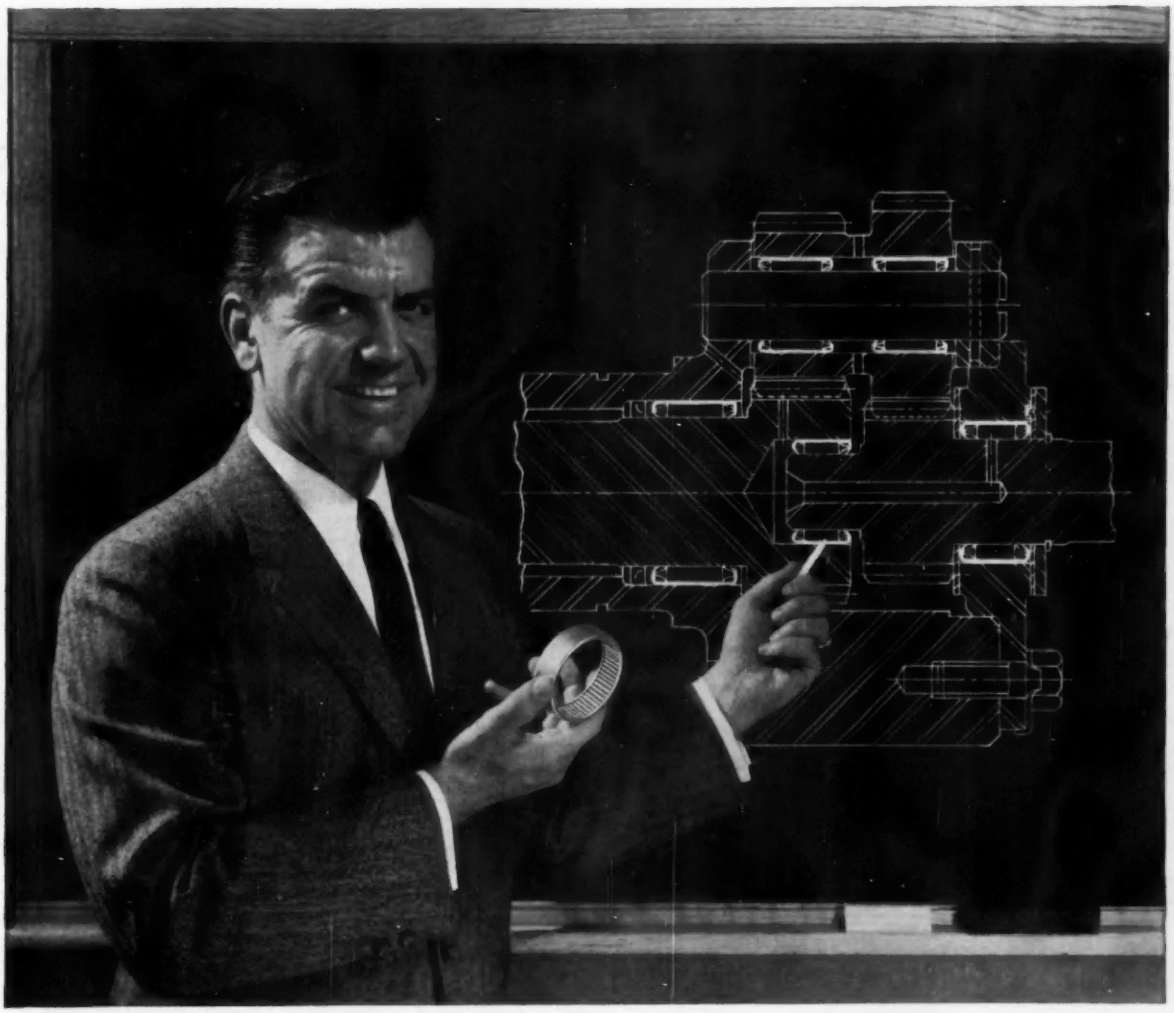
In another of a recent series of advancements in the executive staff at Chrysler Corporation, Paul C. Ackerman, director of engineering since December 1955, has been elected a vice-president of the corporation. Two other executives also were elevated to new positions. They include R. S. Bright, group vice president—basic manufacturing, who was elected to the board of directors, and James C. Zeder, a director and vice president—engineering, who was appointed a special adviser to Colbert.

SALES PICTURE ONE OF MIXED HUES WITH INDIVIDUAL UPTURNS AND DOWNTURNS

Regional Sales of New Passenger Cars

Zone	Region	May 1956	April 1956	May 1955	Five Months 1956	Five Months 1955	Per Cent Change: May over April	May over May 1955	Five Months 1956 over 1955
1	New England	33,099	36,637	40,189	144,761	166,602	− 9.66	−17.64	−13.11
2	Middle Atlantic	124,734	121,275	121,825	479,886	548,079	+ 2.85	+ 2.39	−12.45
3	South Atlantic	70,203	66,151	78,463	321,658	350,087	+ 6.13	−10.53	− 8.12
4	East North Central	136,553	134,063	169,145	642,755	734,265	+ 1.86	−19.27	−12.46
5	East South Central	25,485	26,586	29,533	131,689	137,948	−10.85	−13.71	− 4.54
6	West North Central	46,575	47,891	61,871	220,986	250,239	+ 1.43	−21.49	−11.69
7	West South Central	45,760	48,288	60,638	232,958	237,935	− 5.24	−24.54	− 2.09
8	Mountain	17,885	18,103	21,756	82,185	85,993	− 1.20	−17.79	− 4.43
9	Pacific	57,720	63,278	77,884	291,852	329,384	− 8.78	−25.89	−11.39
	Total—United States	560,014	564,272	661,304	2,548,710	2,840,532	− .75	−15.32	−10.27

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo. Zone 9—Cal., Ore., Wash.



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No one can spot a potential needle bearing application as well as a Torrington engineer.

He will summon the unmatched experience of our Engineering Department to give your product the unique advantages of the Torrington Needle Bearing. And he will draw on our extensive file of previous applications for clues that may help solve your specific anti-friction bearing problems. You can rely on him, too, to review all engineering details so that the application will go into production smoothly and perform satisfactorily in service.

If high radial load capacity, limited space or unit cost enter into your choice of a bearing, chances are you should consider a Torrington Needle Bearing. We may be able to add your product to the thousands which have enjoyed the benefits of this unique bearing.

See our New Needle Bearing Catalog in Sweet's Product Design File—or write direct for a catalog.

TORRINGTON NEEDLE BEARINGS
Give you these benefits

- low coefficient of starting and running friction
- full complement of rollers
- unequalled radial load capacity
- low unit cost
- long service life
- compactness and light weight
- runs directly on hardened shafts
- permits use of larger and stiffer shafts

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AIR BRIEFS

By RALPH H. McCLARREN

Automatic Air Traffic Control

Acceleration of activities toward an ultimate fully automatic air traffic control system has been one fortunate outcome of the recent mid air collision of two transport airlines over the Grand Canyon. The Air Transport Association of America has recommended a permanent post be created within the executive department of the Government in order to develop a long-range program and obtain the necessary action for protection and use of air space as a natural resource and to develop an automatic system of air traffic control for the future.

Milton W. Arnold, Vice-President of Air Transport Association, presented testimony before the Mollohan subcommittee concerning

1. Joint use of airports by military and civil aviation
2. Limitation of private airspace being assigned to Government agencies, and
3. That immediate steps be taken to create new machinery for insuring the development of a proper air traffic control system.

Until a new traffic control system can be developed and installed, interim steps are being taken to expedite safety on the airways. The C.A.B. will probably be authorized to accelerate its $250 million traffic control installation program from five to three years. This will include the installation of more radar monitoring centers and VOR (visual, oral range) transmitting stations.

A committee of airline representatives is being appointed by the Air Transport Association to study and expedite the development of an aircraft proximity warning indicator. Although such a warning indicator is needed now, it will be needed even more so with the advent of the jet age in commercial aviation.

Furthermore, the airlines are accelerating their program to install weather-eye radars which will also provide pilot information on other aircraft ahead of their planes.

Automatic Life Jacket

A new life saving device that automatically inflates a pilot's "Mae West" life jacket upon contact with water has been developed by North American Aviation, Inc. Development of the automatic device was given added impetus by the experience of North American's test pilot, George F. Smith, who was the first man in history to survive a bailout at supersonic speed at low altitude. Smith landed unconscious in the Pacific Ocean, his Mae West was not inflated and had it not been for quick action by a nearby boat, he would have drowned. The automatic inflation device would assure his floating until rescued.

Rocket Altitude Record

A new world's altitude record for a single stage rocket was established on June 29, 1956, by an Aerobee-Hi rocket. The new record altitude of 163 miles supersedes the previous record of 126 miles, achieved June 15, 1955, by the U. S. Air Force with an Aerobee rocket. The previous world record for a single stage rocket was 158 miles made by a Martin-built Viking rocket fired by the Navy in 1954.

The Aerobee rocket is 15 in. in diameter, 372 in. long and weighs 269 lb empty. With fuel weight of 1080 lb and instrument pay-load of 130 lb, the total take-off weight is 1500 lb.

Since the first Aerobee rocket was launched in November 1947 (it reached an altitude of 36 miles), the Aero Jet General Corp., a subsidiary of the General Tire & Rubber Co., has built more than 150 rockets.

Aero Jet General of Azusa, Calif., has recently formed a new subsidiary, the Aero Jet Nucleonics, which will engage in development and production of nuclear reactors.

Today's Aircraft Cost Less per Pound

Although the actual price of modern jet airplanes has increased many times over the World War II models, and future aircraft will cost even more, the cost of today's aircraft is less per pound than the simpler World War II predecessor aircraft.

(*Turn to page* 154, *please*)

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National Acme

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The BUSINESS PULSE

Operating Rate in the Steel Industry Expected to Be Increased to Full Capacity Before the End of This Month. Business Situation, in General, Has Not Been Altered in Any Important Way by the Steel Strike; It Still Is High and Stable.

This Survey Is Prepared exclusively for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Company of New York.

Effects of Steel Strike Minor

The economy does not appear to have suffered any serious and lasting damage as a result of the recent steel strike. This is probably attributable, first of all, to the fact that most steel users possessed rather substantial inventories at the outset of the dispute and, secondly, to the fact that the strike coincided in point of time with vacation periods in many consuming industries. It is true that layoffs and work stoppages did spread to some extent beyond the steel industry itself, but these losses were comparatively small. Certainly they never reached the proportions of those sustained in the prolonged strike of 1952, and they were insignificant by comparison with what they would have been had the dispute continued for another two or three weeks.

This experience of relatively small damage during the strike renders it doubtful that the curve of general business activity has been altered to an important extent. There will be some "catching up" to do, but just how much remains uncertain, in view of the fact that steel consumers during the dispute seem to have drawn in large degree on inventories that had been amassed for the very purpose of getting through a strike. The consensus is that the operating rate in the steel industry will be pushed up to around full capacity before the end of August, but some observers are doubtful that it will remain there for any length of time once supply channels have been filled again. Actually, no firm judgment on this point is possible as yet, for the answer depends not only on the extent to which inventories were eaten away during the dispute but also on just how strong general business activity proves to be during the autumn.

If general business spurts ahead this fall, helped along, say, by enthusiastic consumer response to new-model automobiles, steel production might well hold at the capacity mark for the remainder of the year. In that case, however, the steel industry would be reflecting buoyant conditions in other sectors of the economy rather than generating those conditions itself. Specifically, what seems questionable now is that steel will repeat the vigorous rebound experience that followed the 1952 strike, which undoubtedly did impart a good deal of stimulus to general business in that year and thus modified the curve of activity in a positive way.

But if the strike does not seem likely to be the cause of any significant acceleration of business activity in general, neither does it seem to have had any negative repercussions of a lasting sort. The impact on retail trade certainly appears to have been negligible, inasmuch as there was not enough time for the stoppage of payments to those affected to have extensive chain-like effects. And confidence hardly seems to have been impaired, to judge from the persistent uptrend of security prices throughout the dispute. Steel wages have been increased, of course, and at this writing, steel prices also have been raised by most producers. In the case of one of the largest companies, increases range from $5.50 to $21.00 per ton.

While these increases may very well have effects of an inflationary sort, these would have occurred anyway as a result of the wage increase and hence cannot be blamed on the strike. All in all, it is difficult to see that the business situation has been altered in any important way by the dispute. It still is one of high and relatively stable over-all activity.

Pattern for Wage Settlements

To judge from past experience, the wage increase in the steel industry is very likely to set a pattern for settlements elsewhere. It has been reported, for example, that John L. Lewis will seek benefits of a similar sort for the United Mine Workers shortly. The increase in steel prices, moreover, will be felt in a large number of other industries, some of which will undoubtedly feel compelled to try to pass the higher costs along to their customers.

Businessmen, of course, cannot always raise their

(*Turn to page* 126, *please*)

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How to Choose Plastic Dies

(*Continued from page 57*)

the production departments have a better idea of how much shape can be drawn into a part without tearing, wrinkling, or buckling. When the panels are hand-formed, heating and welding are involved, so that the stresses set up are not necessarily the same as those caused by an equivalent stamping operation. Failure of a hand-formed part can sometimes be traced to the method of fabrication, but failure of a stamped part requires a careful review of the basic engineering design. Thus, if a plastic prototype die shows up certain flaws in a finished panel, the design must be changed or the same difficulties will later be encountered with the production die. Fortunately, the contours of a plastic prototype die are easily changed, whereas rebuilding a metal die would be a job of major proportions.

We estimate the cost of a plastic-faced die to be 30 to 60 per cent less than that of an all-metal die. Therefore, if a manufacturer has limited capital to expend on a die program, plastic-faced dies may be the answer. He gets more die per dollar to start with, and the dies can be repaired, or modified, if need be, as production progresses.

Plastic-faced dies are particularly suitable during any tooling-up period, when the exact shape of the part is still subject to some modification. Sometimes it is easier to form the desired shape in a single press operation rather than in several stages, but this cannot be foreseen until the stamping is actually attempted. Similarly, the most favorable binder line can be determined by trial and error, and the die changed to suit. For this reason, we frequently build a prototype die, which is symmetrical about a center line left to right—instrument panels are a good example—with a different binder line on either side. Then the design which works out better is adopted for the production draw die.

Making engineering changes in plastic prototype dies is relatively easy. All we need do is to cast additional Epon resin formulation over the areas which have to be built up and/or machine those sections requiring it. Such changes usually don't take longer than a few days in a plastic-faced die, whereas we might have to start all over with a metal die. Similarly, a plastic die can be repaired if it begins to show severe wear, and put back into service in short order.

The one area of a draw die which generally shows most wear is the binder line section. It is here that the metal must be clamped with just the right pressure to permit some of it to flow through at a carefully controlled rate. However, since there must be flow, abrasive wear is inevitable. Plastic dies are less resistant to this wear than metal dies. It it important, therefore, that the person responsible for production understands the difference between a metal and a plastic die, or else he may ruin the latter in short order.

For example, a batch of sheet steel occasionally is not of the same high quality as one run through previously. The press foreman, hoping to eliminate tears, may then ease up on the binder line pressure so that the steel slips through more easily. This may or may not damage a high-production die, but with a plastic-faced die any deviation from rigid binder line control shows up immediately as increased wear on the die.

In some cases, wear of a die is not very critical. Automobile roof panels, for example, have more tolerance as far as their balloon shape is concerned. It is possible for the crown of the last panel from a production run of 100,000 to be as much as ⅛ in. lower than that of the first one formed by a conventional high-production die. Therefore, the leeway allowable during a given run may well be one of the determining factors in deciding the type of die to be used.

Allied Products Corp. does not build all-plastic dies, because it has been found from past experience that those presently available do not permit the necessary binder-line control. The all-plastic die has too much resilience, and with such dies we cannot consistently hold the clamping pressure which controls the flow of metal into the die during the press operation.

The sketch, reproduced here, shows the manner in which we normally construct a simple plastic-faced die, good for any run from 50 to 500 pieces. When larger numbers of pieces are required, we incorporate metallic inserts in those sections subject to wear, such as detail No. 4 in the sketch. In practice, the binder line (shaded section) would be made of die iron or zinc alloy rather than plastic.

The following steps are involved in construction of a plastic-faced die: (1) Starting with a model of the part to be formed, a plaster splash is first made. This splash is used for binder development, for making patterns for the zinc alloy or iron cores, and again in step (3).

(2) The various die cores are machined and heels are installed.

(3) The splash—from step (1)—is coated with parting agent, and then a ¼-in. thick laminate of epoxy formulation and glass cloth or glass fiber is built up over it. The face-coat is allowed to cure (harden) overnight at room temperature.

(4) The punch core is carefully positioned about ½-in. away from its corresponding face-coat (the face-coat is still on the plaster splash at this stage) and the resulting cavity is filled with a casting formulation based on Epon resin. The formulations we use are available from Kish Industries, Inc., and other suppliers. When the formulation has cured, the punch is lifted out of the plaster splash. The completed unit then consists of a metal core, a ½-in. thick layer of cast epoxy, and a laminated epoxy face-coat.

(5) After the punch section has been completed, it may be used as a pattern for casting the mating pad. The finished punch is then positioned through the ring to the proper depth. To allow for the thickness of the metal to be stamped, the punch and ring are covered with a layer of beeswax before the final pad contours are cast. This feature of compensating perfectly for the metal to be formed is unique with plastic-faced dies, and may save up to 70 per cent of the time it would take to hand-barber the pad out of metal.

(6) The die is then disassembled and cleaned for use.

(7) If deemed necessary, plastic wear plates are installed between the punch and ring section. The completed die is then ready for tryout.

Epon resin-faced dies, which we have been building for years, offer these advantages: faster delivery, lower costs, and easier construction. If their scope of application is clearly understood and they are properly used, these plastic tools will invariably give satisfactory service.

AUTOMOTIVE INDUSTRIES . . .

Is your News Magazine of Automotive and Aviation

MANUFACTURING

The "NEW LOOK" in Production Stamping

AUTOMATION for the pressroom is just around the corner according to a number of the nation's leading press experts who have studied the revolutionary "Flying Press" approach recently announced by the Wean Equipment Corporation.

Taking a coil of steel directly from the mill, the Wean Flying Press Line decoils, levels, measures, blanks, sorts, counts and piles the finished piece on trans-car ready to be rolled to the next operation—at a speed heretofore considered unobtainable.

Present engineered lines will handle coils up to 72 inches in width—cutting lengths from 12 inches to 8 feet.

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Polish Automotive Plants Tooled With Russian Machines

(*Continued from page* 61)

Clamping is usually mechanical rather than hydraulic or pneumatic, and much labor is expended on tightening bolts with a wrench or hammer.

This was true even in the case of small parts such as connecting rod bearing caps. Although these are rapidly machined over their entire profile by one stroke of a big vertical broach, caps are loaded singly (not in sets) in the simple fixture, then secured by a crude clamp.

There are assembly lines for the engine, gearbox, front suspension and rear axle (the Warszawa is of frameless construction) with fixtures moved by drag chains. Axle test room, engine running bay with water brakes, welding jigs and the paint booths were up to western standards.

Soviet equipment again dominated the press shop, although there were six British Clearing units of up to 500 tons in use. These, it was learned, were supplied by the Russians in 1954 out of deliveries they received from Clearing shortly after the war. In addition, there are many Pels presses from East Germany.

For all this considerable capital outlay, Zeran is running at less than 25 per cent capacity and turning out only some 25 cars a day. Supplies of materials are the biggest bottleneck, with sheet steel the main problem. About 70 per cent of the steel is imported, mainly from the USSR. Now these deliveries have become inadequate, and some material is being bought from West Germany, but not nearly enough is yet available.

The position will improve, it was stated, when the big new iron and steel combine at Nowa Huta becomes fully operational in the next year or so, and the 70-in. wide strip mill there starts production. By 1960 Poland's output of steel is scheduled to reach 7.5 million tons against 4.5 million tons last year, but meanwhile Zeran is suffering from bungled planning. It may have been for this type of mismanagement that the Minister of the Motor Industry was dismissed following the Poznan demonstrations.

Further, while only two per cent of the parts by value are now being imported from Russia, supplies are tapering off since the Pobeda is going out of production in the USSR, to be replaced by the Volga, an entirely different car. These components include the distributor, starter motor, ring and pinion gears for the final drive, and body stampings for the floor and roof.

It was reported that local manufacture of the electrical equipment and even the spiral bevel gears can be undertaken fairly easily, but the complex stampings are a snag in that no triple-action presses are as yet available in Poland. However, the factory manager state that two such presses have been ordered from Pels in East Germany, and that these will be installed and operating in a new building by the end of this year.

Lack of skilled labor is another difficulty, since Poland has little tradition in engineering, and of the 20,000 graduate engineers in that country in 1938 only one-third survived the war. While Zeran was under construction, 200 Polish mechanics were trained at the Gorki plant in Russia to form a cadre on their return home. But the task of training thousands of workers was complicated by the fact that most of them came originally from farms where a few years before they probably had never looked under the hood of an automobile. At present 6000 are employed at Zeran, and this will increase to 10,000 by 1959 when, it is hoped, the full output of 25,000 cars a year will be reached.

Meanwhile the factory is tooled up, and at great expense, to make a model of old design. While the Warszawa is very rugged and suitable for the rough roads abounding in Poland, its power-to-weight ratio is poor, and its uneconomic running is accentuated by the very high price and low quality of gasoline there. For example, the four-cylinder engine of 129 cu in. is a side-valve unit with only 6.2 to 1 compression ratio, and develops 52 hp at 3600 rpm. All components are unusually massive, and the engine with flywheel and gearbox weighs over 580 lb. All castings seem excessively large, such as the bearing caps which are about an inch thick. Another instance of over-weight is the forged crankshaft which has the two center throws in line, and opposing the two outer ones. This configuration requires four main bearings, and a bulky counterweight on the shaft itself.

The cost of retooling for a newer car would be prohibitive at the present time, if only because the small output to date has far from covered the initial investment. Thus production of the Warszawa is planned to continue for the next four or five years. One saving grace for the Poles, however, is that by buying a completely tooled factory and the necessary know-how from the Russians they have telescoped the many stages required to create a motor industry in a country where none had existed.

In addition, the present inefficiency can be tolerated and bankruptcy forestalled because the Soviets provided the entire installation on credit. Repayment does not start until next year, and then it will be in the form of finished cars and spare parts. Since Russia will still have many thousands of Pobedas on the road after its own manufacture stops, Zeran has an assured market for spares and a relatively painless means of paying off the debt.

Meanwhile, the factory plans some modifications to improve the Warszawa in the near future. Engine power will be raised to 65 hp at 3800 rpm by using a better carburetor, increasing compression ratio to 7 to 1, and other alterations. Weight is to be reduced with an aluminum cylinder head and by lightening various components. Appearance of the car will be modernized by restyling the front and rear body sheet metal and fitting a new grille.

In the near future Zeran will also produce the 27 hp Syrena, which shares 60 per cent of its parts with the Warszawa. Production of this model will be limited, however, and continue only for a short time, since this is regarded as a training scheme in anticipation of making a more advanced small car of Polish design.

At the Poznan trade fair which closed on July 1, Poland exhibited several cars, which were stated to be available for export. Star 20 trucks were also shown, and some of these have already been sold abroad, including several hundred to Communist China where they have reportedly withstood severe road abuse.

The basic 3½-ton chassis for this vehicle is of cab-over-engine design, with the 255 cu in. six-cylinder gasoline unit developing 85 hp at 2800 rpm. It is produced as a drop-sided and dump truck, 31-passenger bus, tanker, and tractor.

Another Polish display was a family of medium-size Diesel engines, designated as Wola, which are made under Russian license. Largest of these is a water-cooled V-12 rated at 300 hp at 1500 rpm, featuring direct

(*Turn to page* 106, *please*)

the *CLEARING ROBOT* that's setting records at HOTPOINT

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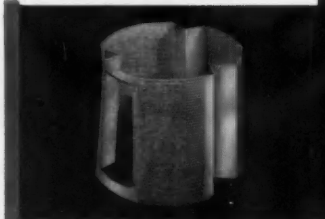
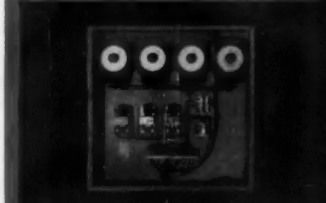


Hotpoint dryer basket after it has been perforated and rolled into its cylindrical shape.



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Host Of Questions *Remain Unanswered* *in* Curtiss-Wright and Studebaker-Packard Deal

By Andrew W. Shearer

BEHIND the bold headlines in the public press early this month dramatizing the recently concluded management assistance agreement between Curtiss-Wright Corp. and Studebaker-Packard Corp. are many unanswered questions. While the broad base of the program to aid the ailing combination of two of the oldest names in the automobile industry has been spelled out, the details had not at press time been clarified. In all probability, Curtiss-Wright has formulated some definite and specific plans for its new partner, but these await announcement until a later date.

As a focal point of reference for the future, it is in order to review the key points of the agreement between Curtiss-Wright and Studebaker-Packard. Thus specific points that are for the present open to conjecture may be highlighted.

S-P Plants Are Leased

UNDER the terms of the program, Curtiss-Wright will pay $35 million to Studebaker-Packard for long-term leases of the latter's Utica, Mich., and South Bend, Ind. (Chippewa) plants. Also included is the purchase of Studebaker-Packard's Aerophysics Development Corp. of Santa Barbara, Calif., and certain other defense assets. Curtiss-Wright plans to operate all three plants as wholly-owned subsidiaries.

Curtiss-Wright states that it will be able to place approximately $200 million worth of defense orders annually in the leased plants. It is assumed that Curtiss-Wright will use the facilities to produce various engine components, spare parts and Diesel engines. Of course, it is conceivable that aircraft turbine engines and missiles now under development will also eventually be produced there.

One final conjecture might be that the added manufacturing space will enable Curtiss-Wright to move into new fields. Already, widely diversified Curtiss-Wright has 16 divisions turning out a variety of products from aircraft engines and propellers to windshield wipers and textile spindles. It is quite likely that some present Curtiss-Wright divisions will become suppliers to Studebaker-Packard.

The above suggested plans that Curtiss-Wright has for the newly leased Studebaker-Packard plants raised the vital question of the future status of Packard Division in particular. The ultra-modern Utica plant has been turning out V-8 engines, automatic transmissions, and axles for Packard cars, as well as some V-8 power plants for the Studebaker Hawk Sports Car series. This raises the question of what will be the principal sources of engines, transmissions, and components for the Packard passenger car line.

Another question arises in the lack of reference to the future of Packard's assembly plant on Conner Ave. in Detroit. This facility had been leased from Chrysler Corp., and it is rumored that Chrysler was notified by Packard some time ago that the latter would not be needing the plant any longer. A corollary question arises in connection with the disposition of the Packard's East Grand Blvd. plant and offices in Detroit.

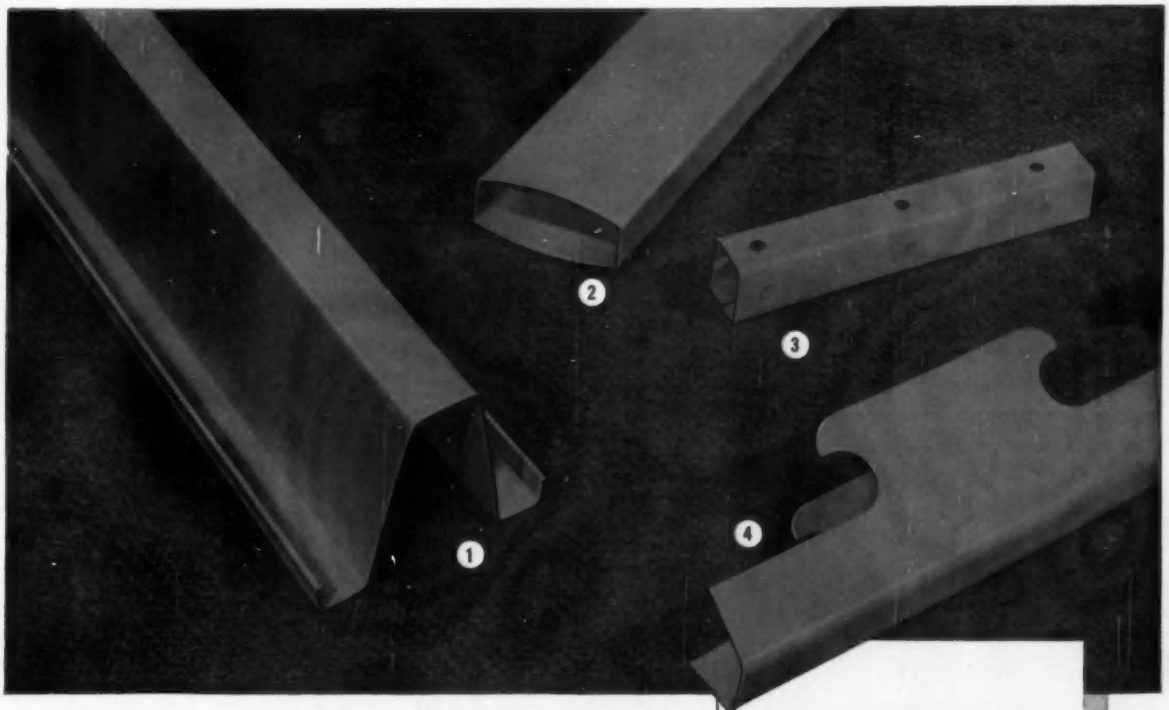
South Bend Automotive Center

THE provision of the agreement that Studebaker Packard-automotive manufacturing will be concentrated at the South Bend facilities further spotlights the enigma regarding the future of Packard. At the present time, Studebaker cars are built in South Bend, whereas Packard cars have been manufactured in the Detroit area.

The announcement stated that a "new and different approach to automotive production and marketing" will be taken. It also said that operations will be conducted in "selected and diversified areas of the automotive field instead of competing on a broad front."

Just what is meant by the terms "selected, diversified" is arbitrary. Since the plans call for a reduction in the number of models offered, it would seem reasonable to assume that the reduction in models would probably affect Packard primarily, but perhaps Studebaker also to a lesser extent. The fact that Harold E. Churchill, former Studebaker vice-president in charge of operations, was named president of Studebaker-Packard Corp., lends added credence to the belief that production and merchandising emphasis will be on the Studebaker line in the future. It should be pointed out however, that this is entirely a matter of supposition.

(*Turn to page* 174, *please*)



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Hunter Douglas Aluminum Corporation

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Polish Automotive Plants

(*Continued from page* 102)

injection, nitrided wet cylinder liners, chrome plated compression rings, and compressed air starting.

Poland unveiled one aircraft at Poznan—the Bies TS-8, a tandem-seat trainer powered by a seven-cylinder radial engine rated at 320 hp at 2350 rpm. Of all-metal construction, it has a 34½-ft span and is 28 ft long, and includes a retractable tricycle undercarriage, slotted flaps, and full radio navigation equipment with blind flight instruments. Maximum performance is given as 195 mph, 1340 fpm rate of climb, ceiling 19,700 ft, and range 435 miles. Series production is scheduled to start this year at Warsaw.

Czechoslovakia and East Germany also exhibited vehicles, and a new Czech truck on show was the five-ton Praga V3S six-by-six with a six-cylinder aircooled Diesel recessed under the forward cab. This in-line unit of 451 cu in. displacement has a peak output of 98 hp at 2100 rpm. Drive is through a gearbox and transfer case giving a total of eight forward ratios, and to the two rear differentials by individual propeller shafts, one of which can be disconnected on smooth roads. The truck was originally designed for military service, and has a high ground clearance made possible by double-reduction gearing in each wheel.

This year the Poznan Fair attracted many more western manufacturers, with France represented in the automotive field by Renault, Simca, Panhard, Chausson and several tractor firms. Daimler-Benz occupied one of the largest outdoor stands with its full range of cars and trucks, and Fiat also took over a big display area. British companies included Standard, Massey-Harris-Ferguson and David Brown Tractors.

Poland's trade with the West is the largest of any Communist state except Russia, and its potentialities are felt to be considerable in view of its sizeable earning capacity derived from coal exports. In the past few years Mercedes-Benz, Standards and Citroen have each sold several hundred cars. These are a feature of city traffic, as are the many Chausson buses in Warsaw. During the fair there were discussions with West German and Italian firms regarding licensing agreements for vehicle manufacture in Poland. Before the war Poland had such an arrangement with Fiat, when it was also the second largest foreign customer for Mercedes cars.

TUNG-SOL® SIGNAL FLASHERS
TUNG-SOL
FLASHER
P273D
12-VOLTS
PAT. NO. 2103276
MADE IN U.S.A.
The "Blink" and the "Tick" Spell Safety
Of all the signals devised for general automotive use, nothing is so commanding, so safe as the flashing light. . . . And the heart of these signal systems is the Tung-Sol Flasher.
In addition to the blinking action, the Tung-Sol Flasher provides for an instrument panel pilot light. This, plus an audible "tick-tick-tick", doubly assures the driver his signals are working.
The fact that the Flasher normally lasts the life of the car is indicative of the complete dependability which characterizes all products manufactured by Tung-Sol, a pioneer in auto lamp engineering since the turn of the century.
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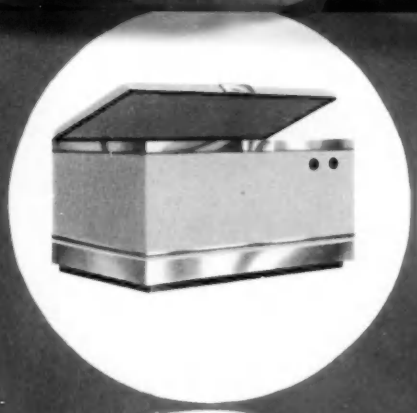
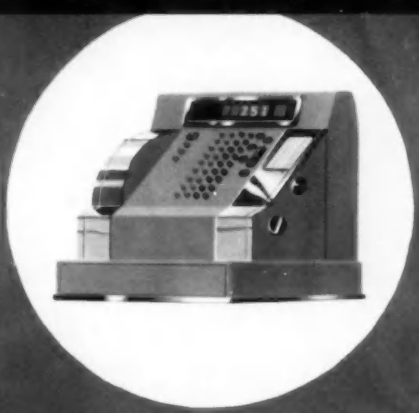
Miniature Lamps
Sealed Beam Headlamps
Signal Flashers
Radio And TV Tubes
Aluminized Picture Tubes
Special Purpose Tubes
Semiconductors

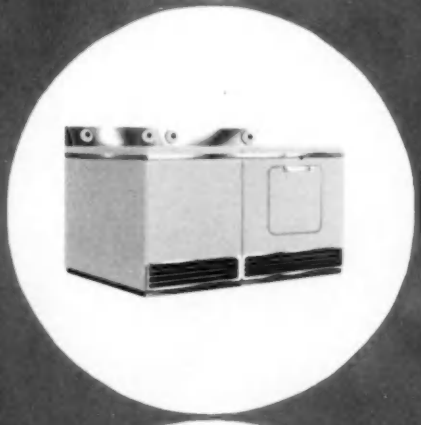
Shot Blasting

(*Continued from page* 55)

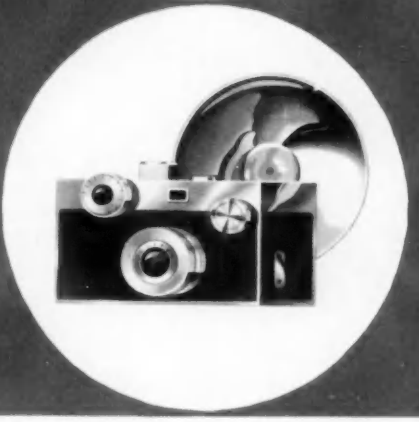
A noteworthy feature of the installation is the provision of individual motorized adjustment for each Roto-blast unit, controlled from the master control panel. The object of this control is to vary the spacing of the units in accordance with the width of the sheet or strip. With this arrangement, the "closing up" of the abrasive blast area for narrower sheets provides for more concentrated blasting intensity and makes it possible to increase the working speed, thus maintaining a uniform tonnage rate regardless of sheet width.







what do all
these modern products
have in common?
*



they're trimmed with the

* permanent beauty and durable utility of **stainless steel**

Beauty with a lifetime shine! Outdoors or in, stainless steel adorns as it resists wear and corrosion—protects equipment against rubs, dents and scratches—puts *selling highlights* on car, counter and camera alike. Stainless is solid-bright. Can't wear off, pit or peel. Design for stainless and specify it always, for faster product profit!

Superior
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Superior Steel
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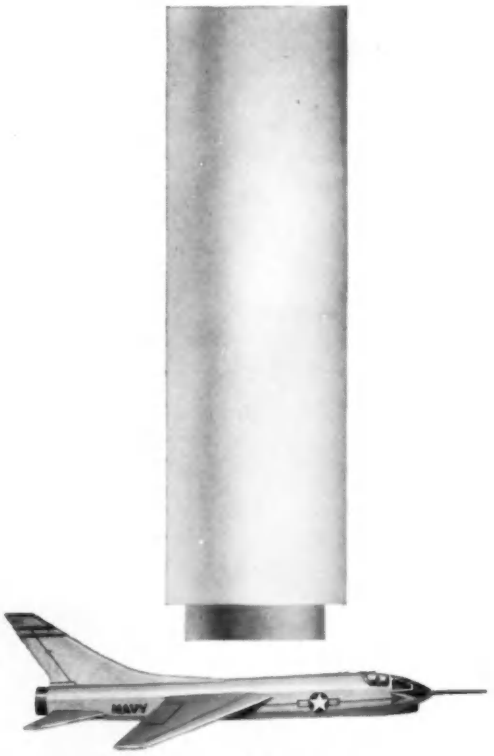
PENNSALT CLEANER A-27 and ALDOX DEOXIDIZER

There's nothing more critical in the spot-welding of aircraft parts than cleaning and deoxidizing. The right cleaning-desmutting-deoxidizing cycle quickly pays its way in eliminating bad welds, assuring fast, accurate fabrication.

PENNSALT CLEANER A-27 gives you the bright, non-etched aluminum surface that's so important to pre-weld deoxidizing. It's highly efficient, too, for cleaning off marking inks, shop soils, and finger marks before anodizing or etching. Water hardness doesn't affect A-27's easy dissolving and free rinsing.

PENNSALT ALDOX®, a balanced acid-chromate material, beats nitric-acid deoxidizing three ways: (1) It's a free-flowing powder, easier and safer to handle than carboyed nitric acid; (2) aluminum parts deoxidized with ALDOX hold a low surface contact resistance (approx. 20 microhms) up to four weeks; (3) you actually save up to 20% in cost of chemicals by deoxidizing with ALDOX.



For cleaner, tighter spot-welds on aluminum aircraft parts

WILLING TO BE SHOWN? Let your Pennsalt representative demonstrate A-27 and ALDOX on your toughest deoxidizing job. Compare the speed, the thoroughness, the economy of this Pennsalt cycle with any other system. Call now for a plant trial, or write Metal Processing Department 216, Pennsylvania Salt Manufacturing Company. East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: 2020 Milvia Street, Berkeley 4, Calif. In Canada: Pennsalt Chemicals of Canada, Hamilton, Ontario.

A-27 AND ALDOX ARE TRADEMARKS OF PENNSYLVANIA SALT MFG. CO.

Pennsalt Chemicals

Metal Cleaners • Phosphate Coatings • Cold-Working Lubricants

A BETTER START FOR YOUR FINISH

Training for Aircraft Production

(*Continued from page* 69)

national Association of Machinists. The committee Secretary is M. J. Boston, management member, who is Superintendent of Manufacturing Training. The other management members are Donald Whitford, Assistant Superintendent—Experimental Flight Center, and Frank Dearborn, Assistant General Foreman — machine Shop. The other union members are Stanford Heieren and Wesley Davies. The Supervisor of Apprentices is H. R. Wilkes, who in turn, reports to J. A. Olmer.

Serving as consultants to the committee are James Fraser, Washington State Supervisor, Bureau of Apprenticeship; and J. J. Barron, Apprenticeship Representative.

The work schedule of tool and die maker apprentices takes 10,000 hours to complete—or about a year longer than that of the machinist apprentice. Many hours are spent in work not included in the schedule, such as tool fabrication and hand finishing, tool engineering, tool tryout and inspection.

Classroom Instruction

Every apprentice is required to attend classes in related instruction at least four hours a week, or 144 hours a year during his training. He is paid the same hourly wage while in the classroom as he receives when training in the plant. He also receives credit on his term of apprenticeship for the hours he spends in the classroom.

The classroom curriculum for machinist and tool and die maker apprentices includes advanced shop mathematics, geometry, trigonometry, reading and interpretation of blueprints, physics related to aircraft production and operation, general information on properties of metals used in aircraft parts and in the tools and machines used in production, safety methods and regulations, and other subjects such as elementary economics and development of the aircraft industry.

The curriculum for aircraft mechanics is similar to the above in many respects, with special emphasis given to pneumatics, hydraulics, power plant, electrical, sheet metal, welding, rigging, wood fabrication, finish and surface controls.

(*Turn to page* 110, *please*)

It's almost THIS easy
... to set up
AUTOMATION GAGING*
with
PRATT & WHITNEY
PACKAGE
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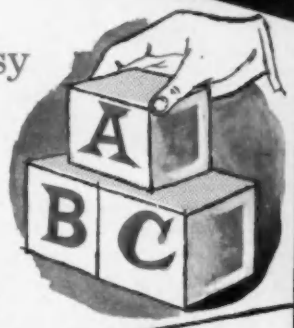
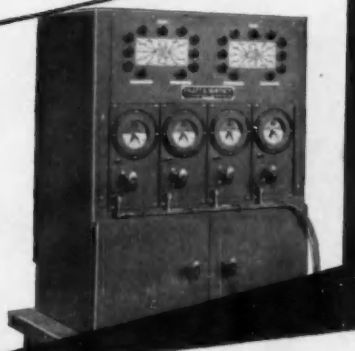


any number
of basic units
can be
assembled
as required



* **Automation Gaging . . .** uses a "feed-back" control system to re-set the machine as required to maintain work tolerances AUTOMATICALLY at all times. The results are: increased production, greater accuracy, fewer rejects . . . and greater profits!

AND NOW . . . an Automation Gaging installation . . . custom tailored to your exact needs . . . can be assembled quickly and easily from standard, in-stock Pratt & Whitney Package Units. The big expense and long delays of specially constructed control equipment are eliminated.

LEARN HOW practical the advantages of Automation Gaging can be applied to your production lines. Phone the nearby P&W Branch Office and ask a Pratt & Whitney Gage Specialist to call at your plant . . . or write direct to West Hartford outlining your requirements.

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Branch Offices and Stocks in Principal Cities
MACHINE TOOLS • GAGES • CUTTING TOOLS

Training for Aircraft Production

(*Continued from page* 109)

Apprentice Progress and Record-Keeping

Although an apprentice produces as he advances from one stage of his training to the next, his production volume is not stressed as a measure of his progress and ability. His workmanship and technical understanding, his development of the needed skills, and his relationship with other workers and his supervisors are used primarily to determine his progress.

Each apprentice is required to keep an accurate record of the time he spends on each job assignment; and this record is carefully checked each week by his immediate supervisor and signed when verified. The record is kept on a standard form for entering weekly records for a full month. At the end of each month the apprentice rating is entered on the form and signed by the shop foreman who transmits the report to the training director.

A similar record is kept of the apprentice's attendance and work in the classroom. Here he is graded by the instructor on a special form listing the subjects in related instruction.

Qualifications and Selection

To be accepted for apprenticeship an applicant must be between the ages of 17 and 23, although war veterans who qualify may be accepted if they are more than 23 years of age. An applicant must be a high school graduate or have an equivalent educational background.

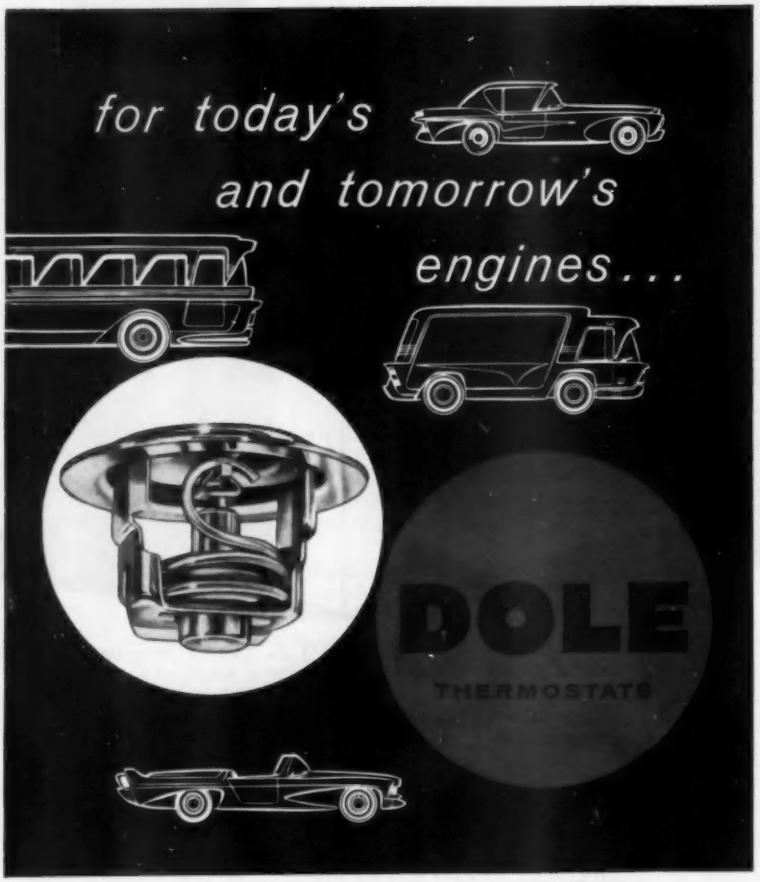
Every applicant must be approved by the representative of the company employment office, the training director, and the supervisor or foreman to whom he will be assigned, if he is accepted. He is questioned closely on his educational background and work experience. He is also subjected to a series of tests, measuring his mechanical ability, his inductive reasoning and visual perception. In addition to the above, he is asked to write a personal letter giving his reasons why he wants a craftsman's career in the aircraft industry and why he wants to serve his apprenticeship in the Boeing plants.

Training Other Than Apprenticeship

The company's program includes, in addition to apprenticeship, training courses in an extensive list of occupations. These courses are given not only in the Seattle plant but in the Renton plant, which is 10 miles from Seattle, and in the Wichita, Kansas, plant.

These courses are given, for the most part, in the classroom and school shops, and may be completed in less than a year. Among the occupations in which this training and instruction are given are: assembly, disassembly and maintenance work; welding and riveting; propeller testing; flight test instrumentation; fueling and refueling; electrical and electronic operations; and processes. All of these courses are included under the general head, "manufacturing training."

The electronic courses in Seattle are planned primarily for employes classified as technicians; and are set up with reference to specific details of the B-52 systems. Technicians who take advantage of the courses receive



these are the reasons why Dole Thermostats are standard equipment on 37 of the leading makes of cars, trucks, tractors, commercial vehicles, industrial and marine engines.

- Positive operation against increased pump pressures
- Good service with all types of antifreeze solutions
- Help maintain best engine performance
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Write for information.

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THE DOLE VALVE COMPANY
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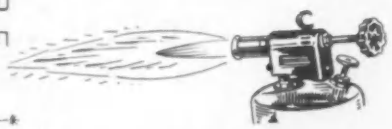
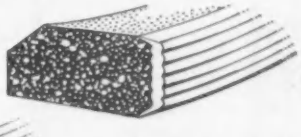
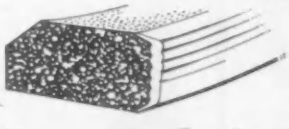
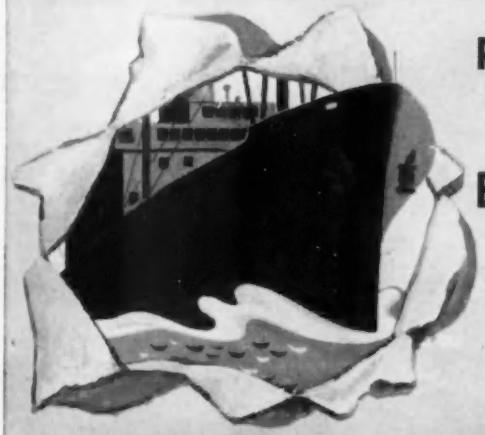
DOLE
(TRADE-MARK)
Detroit Los Angeles Philadelphia

In top grooves where there is too much heat  and too much friction and too little lubrication the only answer is chrome piston rings. Sealed Power chrome rings are the choice of most car makers for original equipment, because the casting is right, the chrome plating is right,  and factory lapping  insures quick seating and immediate oil control. Most factory service sets use Sealed Power rings, too.

Sealed Power Corp., Muskegon, Mich., St. Johns, Mich., Rochester, Ind., Stratford, Ont. 7-236 General Motors Bldg., Detroit.

ORCHARD VPI



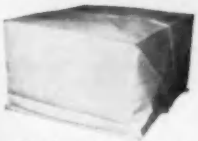
prevents rust on Borg-Warner

ENGINEERING B-W PRODUCTION

SHIPMENTS TO EUROPE

Step 1—Transmissions on Skids

Step 2—VPI Cover



Step 3—Waterproof Cover

Step 4—Crated for Shipment

Borg-Warner International Corporation, Chicago, Illinois, ships transmissions to Europe for use in Mercedes-Benz, Jaguar, and other foreign cars. Wrapping and packaging for overseas shipments is done in the four simple steps illustrated. The use of Orchard VPI paper prevents rust and corrosion, and helps provide the complete protection that keeps Borg-Warner transmissions in perfect condition for two years or more.

Orchard VPI paper is scientifically manufactured to give off an invisible vapor that prevents rust on all ferrous metal parts and products. It is economical and easy to use for packaging, for shipping, and for storage. It saves time and delivers parts in a rust-free condition ready for resale or installation. Orchard VPI is available in sheets, rolls, bags and shrouds—all shapes and sizes to fit your needs.

This four-step packaging for Borg-Warner Shipment was designed, engineered, and performed by Jerome F. Gould Corporation, export packers of Brooklyn, New York and Detroit, Michigan. VPI paper was purchased through Mid-West Paper Products Company, Detroit. Mid-West Representatives: R. M. Reutlinger & Assoc., Dayton, Ohio; Protective Packaging Co., Chicago, Illinois.

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the same pay as when working on the job.

Since most of the electronic equipment is made by sub-contractors, representatives of the contractors assist in the instruction of technical details of modification and installation. Students are given an opportunity for special research work as applied to aircraft operation.

The company also provides opportunities for what is termed "voluntary" training as distinguished from required training. In addition to that are graduate study courses. These courses are designed for the benefit of technical personnel and the managerial staff. Instruction is provided in advanced technical subjects relating to aircraft production and operation.

Periodic training is also provided for journeymen and foremen to keep them informed of advancing production methods, as well as training for instructors in improved teaching methods.

Automobile of the Future

(*Continued from page* 72)

the material. The process selected will, of course, be the one that costs less but that does not sacrifice anything from an engineering standpoint. The choice at present is between automatic forging of steel and shell mold cast pearlitic malleable iron, or shell-molded ductile iron.

The large investment in automatic forging equipment constitutes a major obstacle to a wider acceptance of cast crankshafts. It is my belief, however, that cost savings yet to be made in the shell molding process will tip the balance in favor of the cast crankshaft. Another factor in favor of cast crankshafts is the development of a new alloy by the Research Staff of General Motors. Pontiac has been using this new alloy in the production of cast crankshafts since 1955, and today its entire output of engines uses this crankshaft.

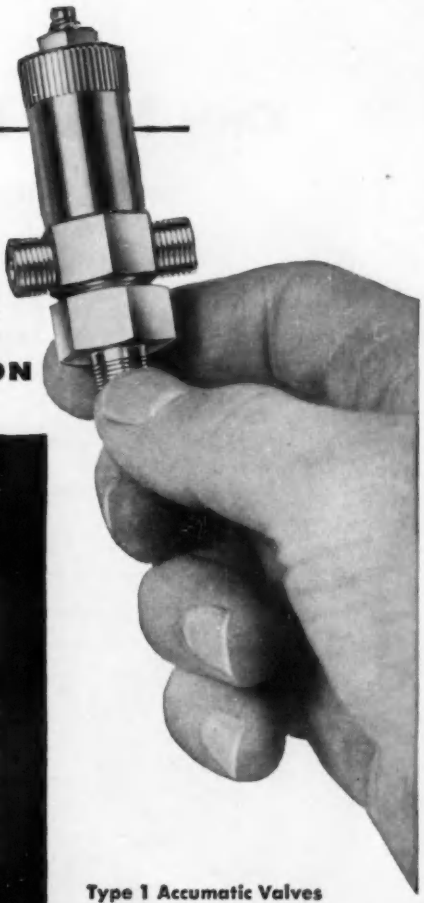
The traditional form of pearlitic malleable iron is not suitable for section sizes much greater than ¾ in. thick. A round section 1¾ in. in diameter is about the limit that can be cast free from "mottle." By the addition of 0.025 per cent bismuth and 0.003 per cent boron, a section up to five inches in diameter can be cast without mottle. This characteristic

(*Turn to page* 116, *please*)

How to cut costs with

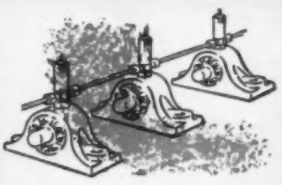
ALEMITE Accumatic

CENTRALIZED AUTOMATIC LUBRICATION

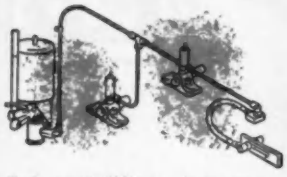


Can be built into any machine, in **4 easy steps**

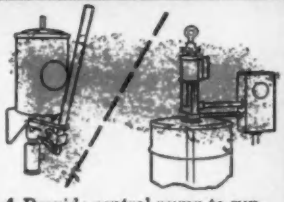
1. Replace grease cups or grease fittings with Accumatic fittings. (Available in same thread sizes as grease fittings, cups.)



2. Connect Accumatic fittings with copper tubing. (Alemite has tubing, clips and accessories for fast, neat installation.)



3. Connect sliding, rotary or oscillating parts into tubing system. (Flexible hose and swivels available for moving parts.)



4. Provide central pump to supply lubricant to system. (May be ordinary hand pump or fully automatic barrel pump.)

Type 1 Accumatic Valves

For fluid oil or light grease. In range of sizes, delivering from .005 to .100 cu. in. of lubricant. Various shapes: Tees, straight-thru, inserts, angles. Spring pressure provides gradual feed. Adjustable or fixed output. System serves up to 400 bearings. Manual or automatic operation available.

Factory-tested—field-proved!

Exhaustive in-the-field tests show no appreciable variation in the amount of lubricant discharged after 73,312 lubrication cycles—equal to 122 *years* of *twice-a-day service!*

Offers All These Advantages!

- Prevents application of wrong lubricant.
- Seals completely against dirt, grit, water.
- No parts are neglected—lubricates inaccessible and dangerous bearings.
- Eliminates product spoilage due to over-lubrication.
- Eliminates point-by-point lubrication methods—services all bearings in one operation.
- Delivers *exact* amount of lubricant to bearing.

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Please send me my free copy of the Alemite Accumatic Catalog.

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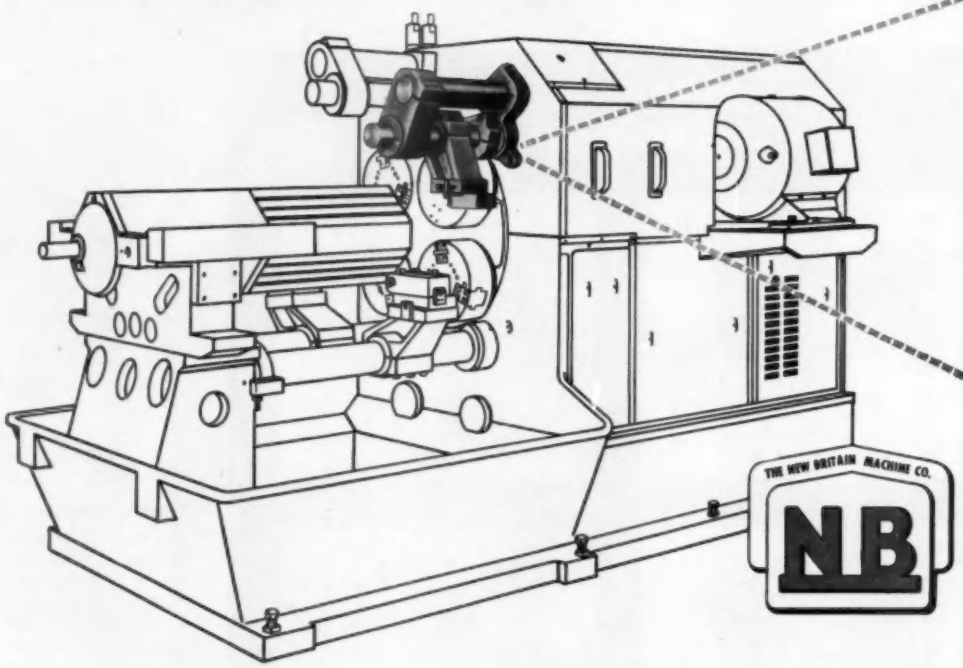
Only **New Britain** *Chuckers offer the EXTRA advantages of*

swinging arms

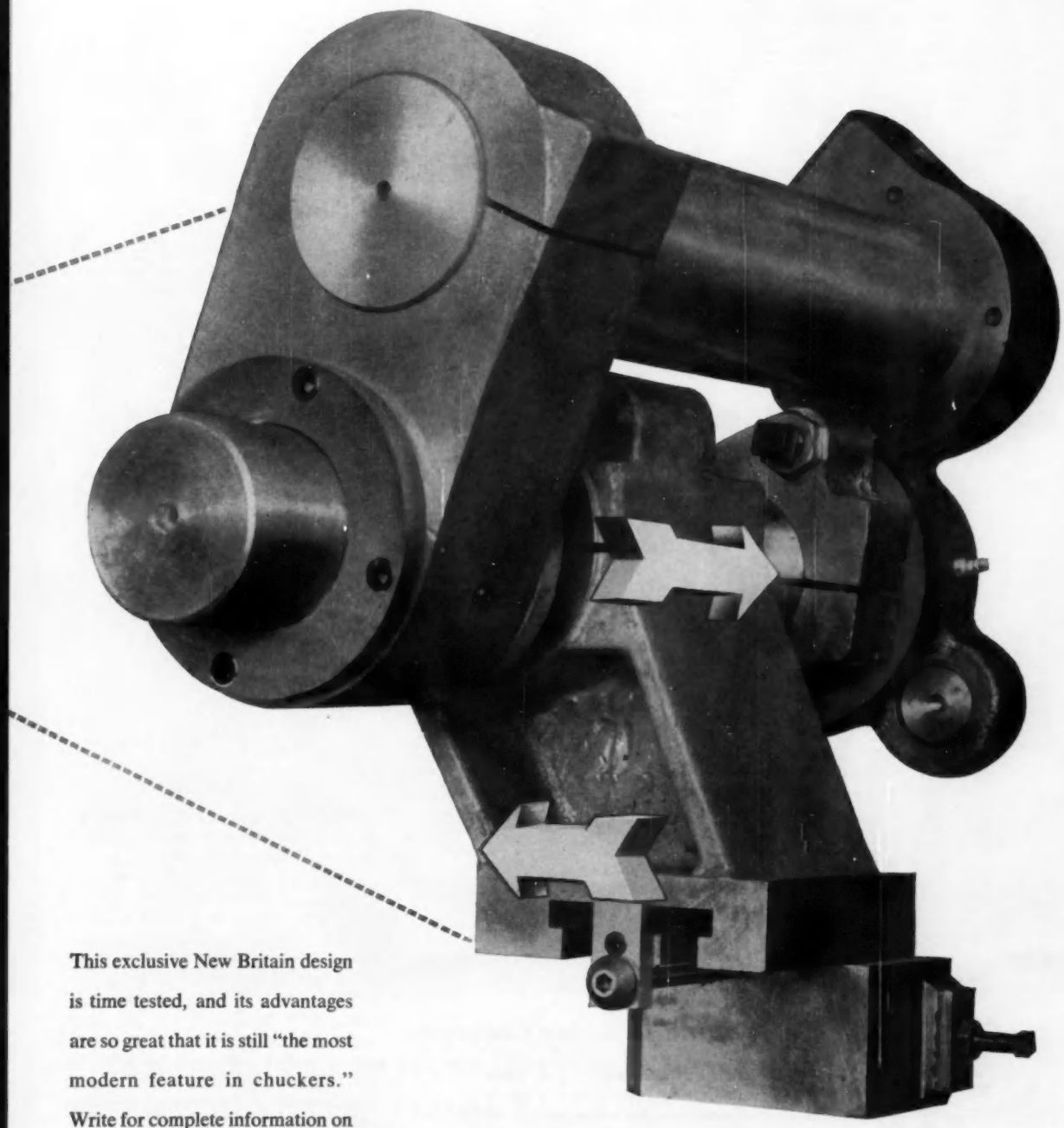


Independent swinging type arms have the PLUS advantage of *longitudinal* action. The combination of radial and longitudinal motion permits a variety of operations which often makes the difference between a single machining and the need for secondary operations.

Arms are positionable horizontally for *any length of work*, and each is operated independently through separate cams. Bearing surfaces are located away from wear-producing grit and grime. Together with New Britain open-end construction, swinging arms afford wide-open accessibility and more chip room.

NEW BRITAIN-GRIDLEY MACHINE DIVISION

The New Britain Machine Company — New Britain, Connecticut



This exclusive New Britain design is time tested, and its advantages are so great that it is still "the most modern feature in chuckers." Write for complete information on New Britain four-, six-, and eight-spindle machines, *now* with chucking diameters up to 15 inches.

Automobile of the Future

(*Continued from page* 110)

makes the iron suitable for use in crankshafts or other heavy section castings.

It is interesting that the objective of the original development was to produce a faster annealing malleable iron. The idea was to raise the silicon content to produce faster carbide decomposition and then to introduce a carbide stabilizer that would counteract the action of the increased silicon and prevent graphite formation during solidification, but which would not interfere with carbide decomposition during annealing. Tellurium turned out to be such a stabilizer.

Tellurium was later replaced by bismuth, which was found to give more uniform results. Tellurium treated malleable iron was used for the pistons of the Diesel engines used in the early Diesel locomotives. These replaced the original aluminum pistons because of greater durability.

It was during the manufacture of these large pistons—10 in. in diameter—that it was found that castings of larger section size could be made with the aid of tellurium. These castings, made from regular malleable iron, would have required a drastic reduction in silicon content to avoid mottle, with the result that annealing time would have been greatly increased. The way it turned out, by using tellurium and increasing silicon somewhat, the castings were anneable in the same cycle used for the standard run of smaller castings, which at that time was around 36 hours. The effect of bismuth is similar to the effect of tellurium.

An important saving secured by shell mold casting the crankshaft is realized because the crank cheeks can be cast sufficiently accurate, so that crank cheek machining is eliminated. Another saving results from the fact that machinability of the pearlitic malleable is much better than that of steel. These crankshafts have proved satisfactory in every respect, both engineering and cost-wise.

The cost reductions we can see coming up in connection with manufacturing these crankshafts are going to create pressures that may be strong enough to make it necessary to change all crankshafts to castings.

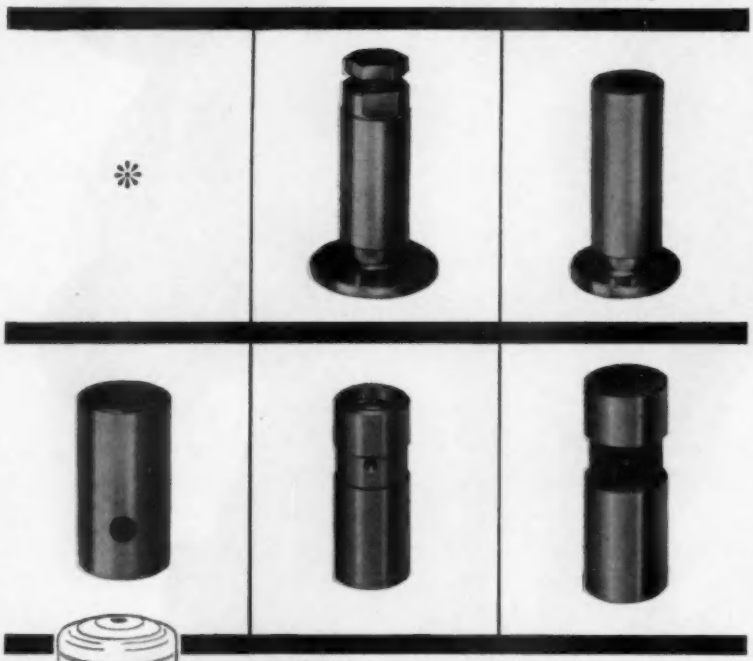
NICKEL SUBSTITUTES

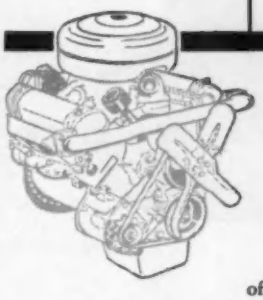
World War II stringencies gave impetus to the transition in the composition of alloy steels used in gears, shafts, and other highly stressed members, The new understanding of hardenability and its relation to alloy content pointed the way to substitutions of less strategic alloys in place of nickel, so that today nickel usage in these steels is relatively insignificant. SAE 4615 with 1¾ per cent nickel and 8620 and 8640 with 0.65 per cent nickel account for most of the nickel used in alloy steels in automobile construction today, excluding valve steels.

The trend to eliminate nickel is continuing because it is still in short supply, so that the future car will use no nickel in shafts and gears. A steel containing 0.50 per cent molybdenum and 0.50 per cent manganese has been used successfully as a substitute for 4615. By adjusting the molybdenum downward to obtain hardenability in the range of 8620 and 8640, that last outpost of nickel usage could also be dispensed with.

Another part of the automobile to be affected by increased attention to

JOHNSON *tappets*





keep pace with today's engines

Continual experimentation and excellent manufacturing methods show a steady product improvement that make JOHNSON TAPPETS worthy of your consideration. Only proven materials, covering a range of steel, chilled iron, and various iron alloys are used in the manufacture of JOHNSON TAPPETS, providing greater strength, light weight and increased wear resistance. Serving the AUTOMOTIVE — AIRCRAFT — FARM — INDUSTRIAL — MARINE Industries.

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Backed by Vast Production Facilities, Packard Electric Can Supply All Your Cable Needs

Whether it is a simple cable component or a complex wiring harness ready for snap-in installation . . . you'll find that Packard Electric is ready to supply all your automotive cable needs. You can be sure of uniform quality, high-volume delivery, on time, and a price that is right.

These are the reasons why Packard Cable is original equipment on more cars and trucks than all other cable combined:

RESEARCH . . . a continuing program at Packard, where you will find the world's most complete automotive cable research facilities available to solve your cable problems.

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Your cable needs are no problem when you deal with Packard, the industry leader in automotive wiring.

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the POWER and PERFORMANCE OF YOUR PRODUCT

There's hardly a power driven machine built that doesn't depend on gears for its get-up-and-go—its productivity—and very often *its reputation.*

No wonder, then, why more and more manufacturers insist on Fairfield Gears for their QUALITY—and also for their mass-production ECONOMY.

No matter what type or size of gears you require, it will pay you to check with Fairfield first. Take advantage, too, of Fairfield's helpful engineering services. *Your inquiry will receive prompt attention.*

Ask for interesting, illustrated bulletin.

Fine Gears Made to Order

SPUR GEARS—Straight, helical, and internal. Sizes from 16 pitch, 1½" dia., to 1½ pitch, 36" dia.
HERRINGBONE—(Fellows Type). Sizes from 1½" to 15".
SPIRAL BEVEL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 28" dia.
STRAIGHT BEVEL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 28" dia.
HYPOID—Sizes from 1½" to 28" dia.
ZEROL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 21" dia.
WORMS AND WORM GEARS—Worms to 7" dia. Worm gears to 36" dia.
SPLINED SHAFTS—Lengths to 52". Diameters from 1" to 6".
DIFFERENTIALS—10,000 to 300,000 inch pounds capacity.

Note: All sizes above are approximate.

FAIRFIELD MANUFACTURING CO.

for FINE GEARS

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lower weight and scarce materials will be the radiator. As copper becomes more expensive and scarcer, the urge to replace it with aluminum will become greater. By 1980, I expect our radiators will be made of aluminum.

No mention has been made of titanium because we do not see a legitimate use for it even if the price were low enough to make it economical. The structure of the automobile is such that weight saving can be accomplished better with aluminum and magnesium than with titanium. The only exception to this would be for gas turbine components operating in a temperature range between 500 F and 1000 F, where aluminum or magnesium would be inadequate.

The foregoing is an abstract of a paper presented by the author at the First Annual Detroit Conference on Tooling and Materials in June, 1956.

Automatic Buffing

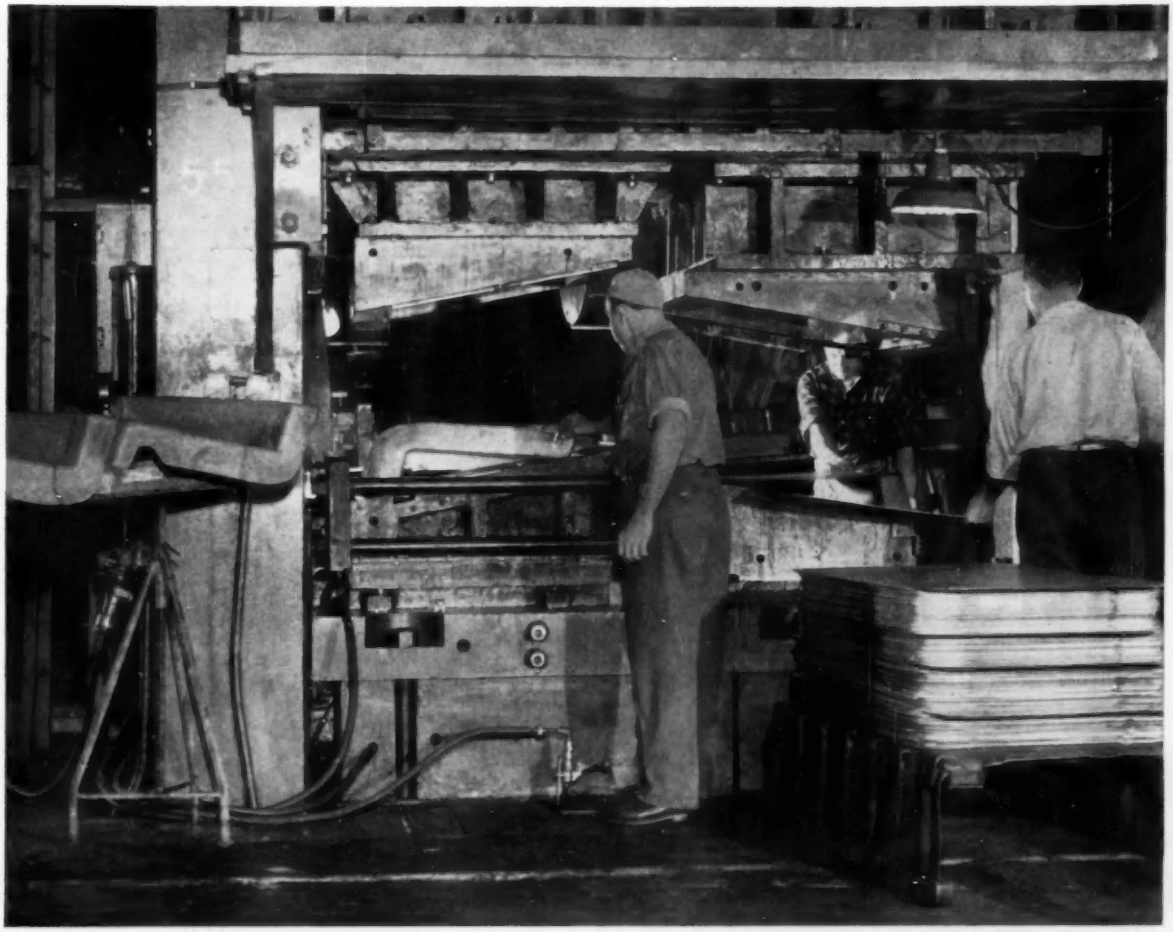
(*Continued from page* 64)

The Gyro machine has a central column supporting a spider that, in turn, supports three pendant heads. This spider is elevated, indexed and lowered thrice in each cycle of the machine. Upon being lowered, two heads enter barrels where the castings carried by the heads dip into the abrasive mixture, at the same time covering the barrels. While in the barrel, each casting is indexed into three positions as it plows through the abrasive mixture which is moved by barrel rotation.

At the end of a given time, all heads are elevated and are indexed again. When lowered, the head not entering either of the barrels, comes to rest in a space where the castings it supports are unloaded and are replaced by new castings ready to be polished. Castings are received via one conveyor from the line where flash was removed and, after treatment, are placed on another conveyor for advance to the plating line.

Figure 5 shows the Gyro machine with the spider elevated for indexing. Barrels are accessible from a platform where the polishing ingredients are added. Mixture that falls from heads as they index is recovered and reused. Attendants do loading and unloading as well as inspection of castings removed and also keep the mixture in barrels in proper condition and at desired level.

There is a substantial saving over buffing, as, for a casting of this shape, considerable hand buffing would be re-



No wrinkles . . . no checks . . . no cracking

Yes, Youngstown Sheets and Strip have exactly the right combination of tensile strength, ductility and surface finish to form perfectly in your presses.

And just as important, they have the uniformity of quality that enables you to run even the most difficult part hour after hour without jam-ups and with a minimum of rejects.

The Youngstown District Sales Office near you is there to help you. Get in touch with us whenever we can be of service.

QUALITY YOUNGSTOWN SERVICE

Youngstown

COLD ROLLED SHEETS AND STRIP

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

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quired to insure desired brightness all over. Although used at present only on hood ornaments, the machine can be adapted for other castings. Its capacity can also be increased by using two more holders per head, as there is now space for six holding arms per head.

Entirely different and much faster is the new wet burnishing machine, Fig. 7, as it employs a (wet) slurry to do burnishing and uses a special form of rotary rubber brushes, called "mats," to rub the slurry across the surfaces to be burnished. Its purpose is to obtain a finish equivalent to buffing in its effect without the dirt and expense involved in using cotton buffs and conventional buffing compounds. Actually, the finish produced has a slightly frosted appearance and is not so bright as that produced by buffing but bright plating done on the surface has luster equaling that on buffed parts and charges, both for labor and materials, are much less than for buffing.

In the wet burnishing machine, stampings are clamped to fixtures attached to a spider, Fig. 8, that rotates slowly but continuously in an inclined plane, the bumper guard stampings being loaded at the high side of the spider where there is no slurry. After leaving the loading station, however, each stamping is carried through a semi-liquid slurry that consists of amorphous silica, finely ground, mixed with a proprietary substance that helps to keep the silica in suspension in water, which constitutes 30 to 35 per cent of the mix.

While in this slurry, each stamping passes under eight rubber mats, each 16½ in. in diameter and driven by its own 7½-hp motor at 400 rpm. Mats are disks of rubber that lie against a steel flange. On the outer surfaces, the mats have fingers about 2½ to 3 in. long, usually conical in shape, and about ½-in. diam where they join the disk. Each mat is so placed that the fingers wipe the slurry across a given area of each stamping as it is advanced by the spider.

Rotation of mats causes the slurry to be thrown about but, as the annular channel is closed, the slurry flows back and is constantly circulated. No slurry is lost save the thin film remaining on each casting as it emerges from the burnishing area and this small amount is washed off and largely recovered for reuse in a subsequent operation.

Stampings unloaded from the wet burnishing machine are placed on racks and are passed at once through two cold and one hot water spray and then through a hot air dryoff. This makes the castings ready for plating. Slurry washed off is settled out and is returned to the machine for reuse. Burnishing is much faster than buffing and, as materials also cost much less, economy is high. Absence of dirt makes it unnecesary to have an exhaust system. Space requirements also are smaller than for buffing equipment.

MASS MARQUENCHING

(*Continued from page 67*)

begins immediately after the work is on the elevator. An interesting feature of this setup is that the furnace atmosphere is carried right over the quench tank so that the parts are not exposed to air before quenching.

As a result of this marquenching operation, combined with the close control of carbon concentration through careful furnace operation, a fine martensitic case structure is obtained on the gears. One typical gear

PAYLOADER® by HOUGH
is built to be TOUGH!
BORG AND BECK
CONVERTER and CLUTCH
are coupled in the husky new Model HA "PAYLOADER" to give it a rugged, trouble-free TORQUE CONVERTER DRIVE which multiplies output and provides smooth, shockless power flow for severe service.
Whatever your clutch or converter application, consult our engineering department without obligation. Like Hough, you can always depend on Borg & Beck to come up with the right answer.
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Extra Rugged...

For The ROUGH Hobbing Jobs!

THE BIG
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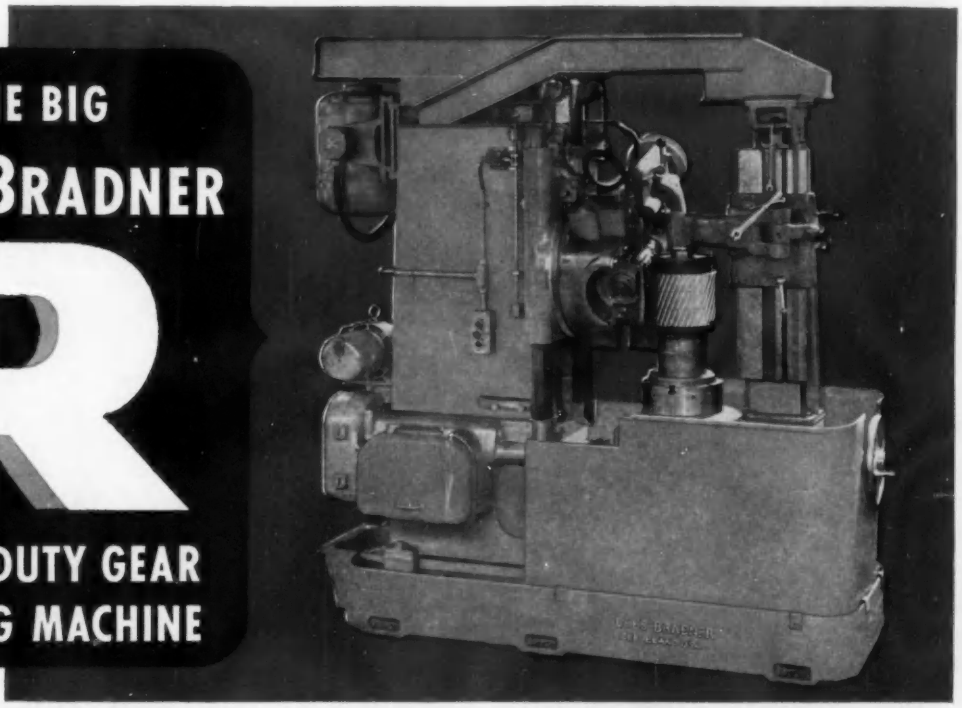
HEAVY-DUTY GEAR
HOBBING MACHINE



Built rugged and reliable to handle those rough, tough gear hobbing jobs . . . that's the new Lees-Bradner Model "R".

It's designed to hob spur or helical gears up to 1¼ DP with a left or right hand maximum helix of 45°.

The Model "R" features fast loading and unloading, ready access to index and feed change plus easy operation and maintenance.

Write for your free brochure giving the detailed capacities and specifications of this new heavy-weight hobbing machine.

SPECIFICATIONS

Maximum outside diameter with tailstock column	16"
without tailstock column	18"
Minimum C/D hob to work	1½"
Maximum C/D hob to work	12"
Travel	18"
Maximum diameter of hob (3-1, 6-1, or 12-1 backgearing)	10" x 10"
DP range	1¼ DP to 16 DP
Maximum manual (or electric) shift of hob	6"
Diameter of hole through work spindle	2"
Machine weight	13,000 lbs.

the **LEES-BRADNER** *Company*

CLEVELAND 11, OHIO • U.S.A.

RANSBURG
Electro-Spray
DOES IT BETTER... FOR LESS

Look what Ransburg Electrostatic Spray painting is doing in this eastern job shop, the Del-Val Finishers Division of J. W. Rex Company, Lansdale, Pa.

As a job shop, Del-Val handles a variety of work each month, painting hundreds of thousands of pieces and parts of various sizes and shapes.

The versatility and flexibility of Ransburg Electro-Spray makes it ideal for their varied painting requirements. Here's a typical example. Del-Val recently completed a contract for a Philadelphia manufacturer of barbecue trays with these results:

50% INCREASE IN PRODUCTION

50% SAVINGS IN LABOR and OVERHEAD

66% CUT IN PAINT COSTS, with improved, more uniform, and higher quality finish.

The job—flat sheet steel, 11" x 19"—enamel coated to withstand a 90 bend with sharp radius. Full coat one side; mist coat other.

WITH RANSBURG ELECTRO-SPRAY		BY FORMER HAND SPRAY	
Output, 375 panels per hour with 3 men		Output, 250 panels per hour with 4 men	
	per panel		per panel
Labor and overhead	.06	Labor and overhead	.12
Paint & lease cost	.017	Paint cost	.044
TOTAL COST	.077	TOTAL COST	.164

Want to know what Ransburg Electro-Spray can do for you in YOUR finishing department? Write for our new No. 2 Process brochure. It tells the WHAT & HOW of electrostatic spray painting, and with numerous production-line examples, shows how other manufacturers are cutting finishing costs... increasing production, and improving the quality of their work with Ransburg equipment. Too, we have available now a new movie, "The Big Attraction," a 27-minute sound and color film on electrostatic spray painting.

Ransburg ELECTRO-COATING CORP.
Indianapolis 7, Indiana

RANSBURG

is made from a steel with the following analysis: Carbon 0.21 per cent, manganese 0.76 per cent, nickel 3.45 per cent, chromium 0.08 per cent, silicon 0.23 per cent and molybdenum 0.25 per cent—corresponding approximately to an SAE 4820 steel. By this method, the following hardnesses were achieved on various portions of the gear teeth: On the surface of the teeth—Rockwell C 60.5; core hardness at the pitch line—C 43; core hardness at the root line—C 38; core hardness ⅛ inch below the root—C 38.

Because gears are now produced with a minimum residual stress, service life has increased 100 to 200 per cent, compared with gears produced by the former method. Load-carrying capacity, as determined by dynamometer tests, has been increased by 15 to 20 per cent. As a result of elimination of distortion, tangible production benefits have been realized. For example, in one transmission with 13 carburized parts, five parts were formerly press quenched, five plug quenched, one individually quenched, and two batch quenched. Now these parts are all batch quenched with tolerances within desired limits.

A great deal of the success of the new carburizing and marquenching treatments is due to extensive use of specially designed high alloy trays and furnace parts, which withstand the severe conditions of temperature, atmosphere and thermal shock. Trays used to support the gears in the carburizing furnaces are made of type HT cast alloy (35 per cent Ni, 15 per cent Cr). These trays are of a rigid but lightweight design since the loading in these furnaces is quite heavy due to the additional weight of special alloy fixtures on which the gears are placed. These alloy trays must withstand the carburizing atmosphere, as well as the elevated temperatures in all three zones of the furnaces, which vary from about 1650 to 1700 F. More important, from the point of view of the tray life—because the trays go through the quenching tank with the work—the castings must resist the drastic thermal shock involved in reheating and quenching.

Loading fixtures on which gears are placed prior to the carburizing operation are also made of high alloy castings. These special fixtures enable the gears to be loaded in a horizontal plane, which is a great advantage in obtaining uniform properties. For larger pieces such as first speed transmission gears, typical loading would be 24 pieces on a fixture; for smaller gears, 36 pieces would be loaded at one time.

Get your brake or transmission idea "off the board and on the road"...faster!
FACILITIES OF
American Brakeblok
SINTERMET
Research and Test — Mahwah, N.J.
Road Test — Toms River, N.J.
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Production — Winchester, Va.
Cleveland, O.
Hillburn, N.Y.

Why American Brakeblok can slash time and still meet toughest specs

Research: Your new friction engineering problems may already be solved, or are well on the way to solution. Hundreds of formulas for asbestos-base, semi-metallic and metallic friction materials have been developed by our research staff, and are ready now for tomorrow's needs.

Testing: Continuous testing in the lab and on the road enables us to provide comprehensive reports covering every factor influencing performance and service life. In many cases, this service saves our customers weeks of exhaustive testing.

Production: Three modern plants in the U. S. A. can meet the needs of millions of vehicles and machines every year. Point-by-point production, precisely controlled, insures top quality of every part.

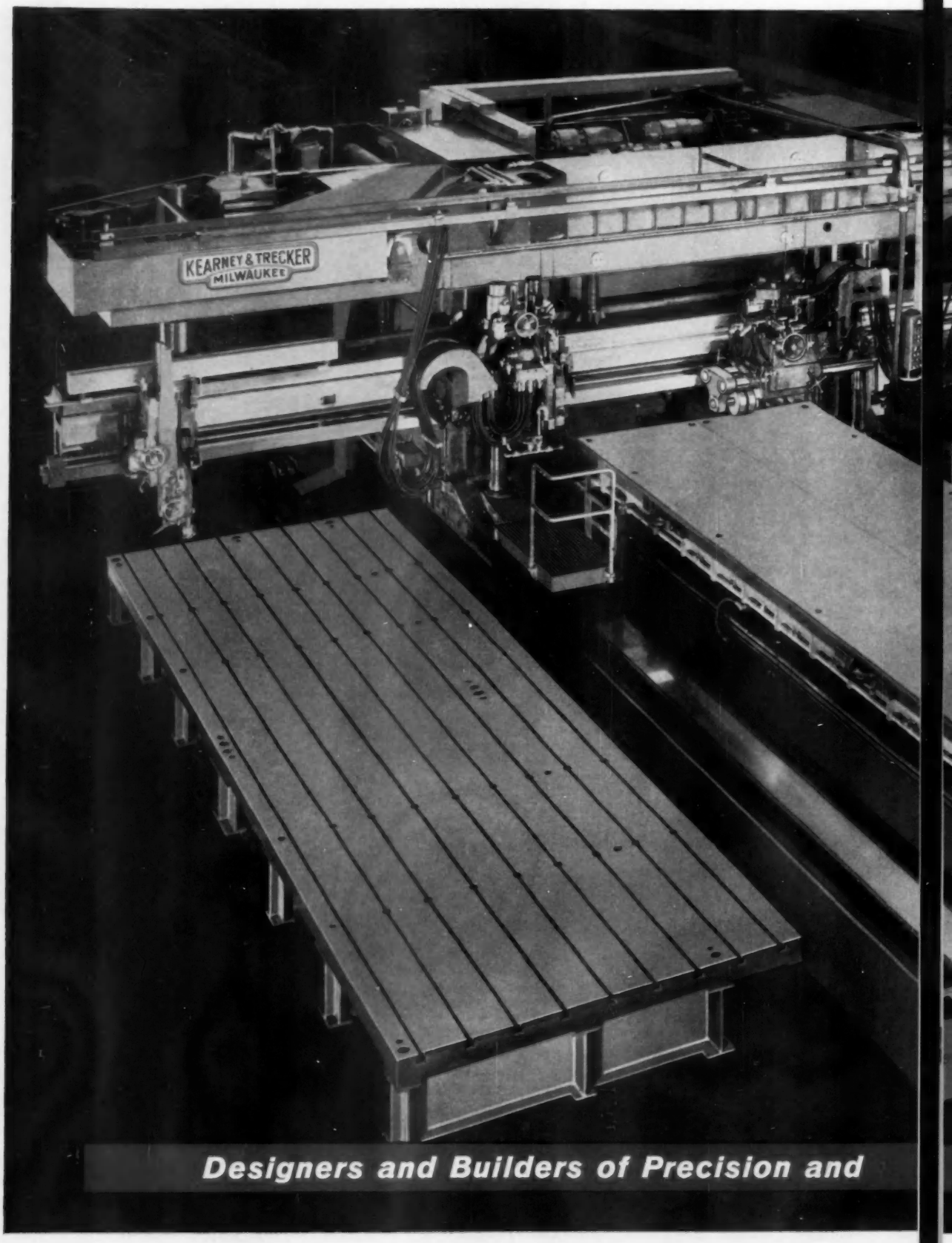
Service: Sales engineers are your liaison with ABB. They know their field, and are at your disposal—virtually members of your project team. Even when design changes in midstream, they can shift ABB to meet the new requirements immediately.

• • •

To take full advantage of these American Brakeblok facilities, we suggest you check with us during your initial planning stage. A call or letter will bring immediate action.

Brake Shoe

AMERICAN BRAKEBLOK DIVISION
DETROIT 9, MICHIGAN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MILWAUKEE
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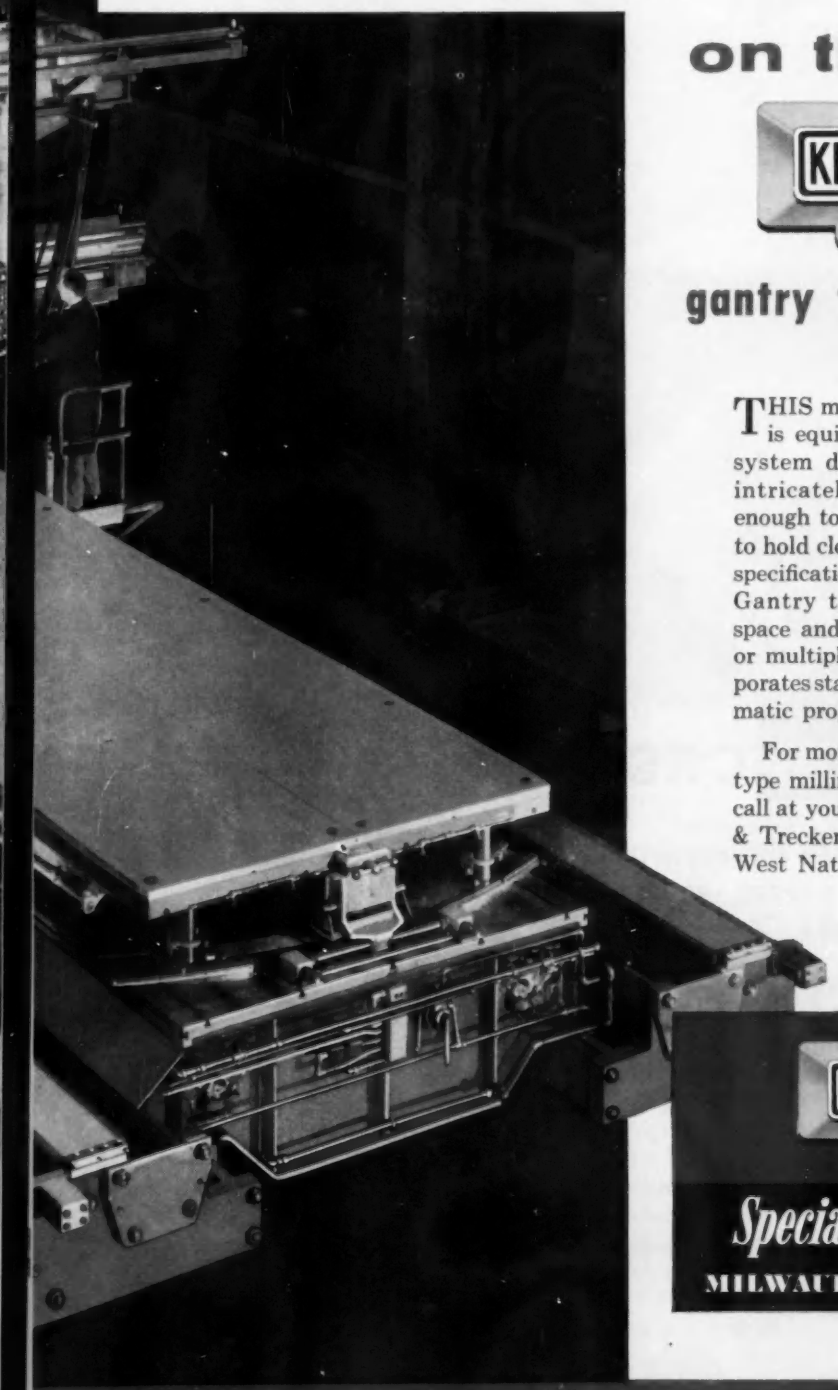
Picture your workpiece on this 175-ton

KEARNEY & TRECKER MILWAUKEE

gantry type milling machine



THIS massive giant, 42 ft. long, 35 ft. wide, is equipped with electronic tracer control system designed for production milling of intricately contoured workpieces. Rugged enough to mill all metals . . . sensitive enough to hold close tolerances . . . it meets all A. I. A. specifications and has extendable bed design. Gantry type machine takes much less floor space and permits handling larger workpieces or multiple workpiece setups. Machine incorporates standard design components with automatic programming control systems available.

For more specific information on this gantry type milling machine, have our representative call at your convenience . . . or write to Kearney & Trecker, Special Machinery Division, 6774 West National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE

Special Machinery Division

MILWAUKEE 14, WISCONSIN, U.S.A.

Production Machine Tools Since 1898

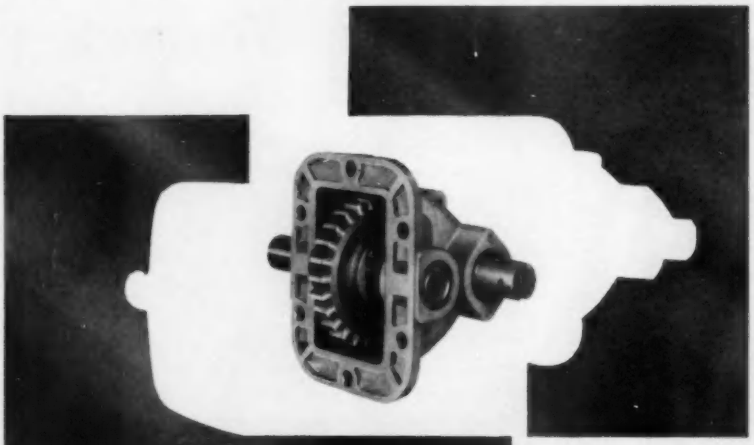
BUSINESS PULSE

(*Continued from page* 98)

selling prices with impunity, especially if their products are being sold in markets and at a time characterized by keen competition. When such competition prevails, an attempt to raise prices leads to a decline in sales, which ultimately is reflected in output and employment practices, if the price advance is not revoked. To some extent, there is bound to be a restraint of this sort on the inflationary forces generated by the advance of wages and prices in the steel industry.

Inflationary Forces

Yet it seems doubtful that this type of restraint can fully negate these inflationary forces, since it is likely that monetary authorities will feel under some pressure to accommodate price advances in the interest of maintaining large business volume. Monetary authorities are, in effect, faced with a choice of evils. If they do not tailor their policies to take account of wage-price advances in industries as important as steel, some of the buoyancy is likely to go out of business, since there is a very good possibility that businessmen will meet with resistance in trying to pass higher costs along and hence will either have to curtail output or else absorb the higher costs. If, on the other hand, monetary authorities ease money so as to accommodate the process of passing along higher costs, the result is a higher level of commodity prices and thus a depreciation of the monetary unit. It appears that monetary authorities customarily feel under some pressure to elect the second alternative, and the fact that they do underlies the present expectation that the wage-price advance in the steel industry will have inflationary results.



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IT'S THE DIE-CAST ALUMINUM HOUSING FOR THE NEW TULSA® SINGLE SPEED, MEDIUM DUTY POWER TAKE-OFF!

The die-cast aluminum housing makes this NEW TULSA power take-off "light as a feather" . . . gives it all the strength and durability for which the TULSA line is famous. Output shaft rotates on two needle bearings and is manufactured in three sizes—13/16", 7/8" and 15/16". It's available with either cable or lever control. Designed and built to cover the full market range of a thoroughly dependable, low priced, single speed power take-off for medium duty work. Same nationwide distribution and service as offered for the full TULSA line of power take-offs.

Tulsa Winch
TULSA, OKLAHOMA DIVISION OF VICKERS Inc.

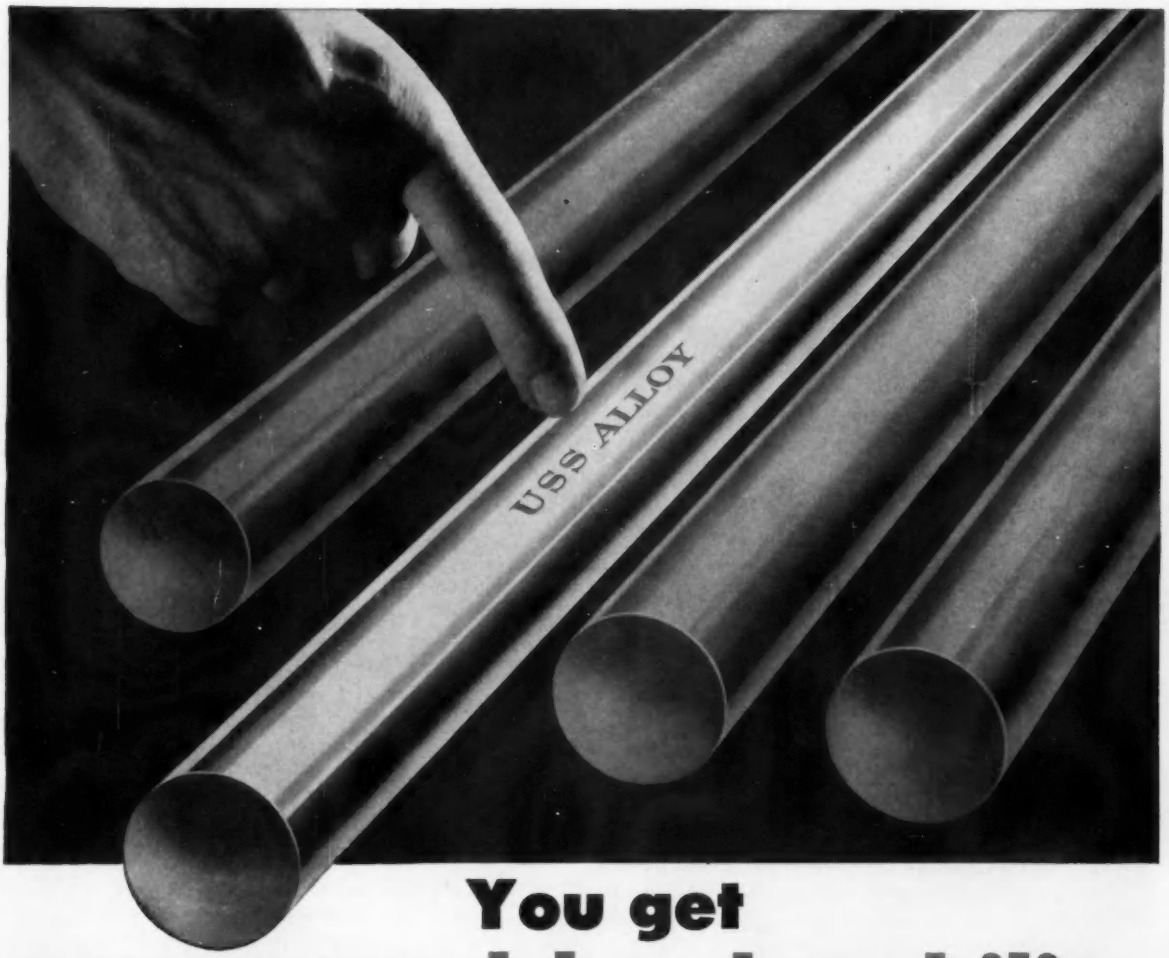
Road Program as Business Builder

The program of road construction provided for in the recently enacted Federal-Aid Highway Act of 1956 has important economic implications for the longer term. The program involves plans for the modernization of the 40,000-mile Interstate System over the next 13 years and also for an acceleration of expenditures on the Federal-aid primary and secondary systems. Expenditures on the Interstate System alone are scheduled to total about $28 billion for the 13 years. Vast quantities of materials, labor and engineering "know-how" will have to be mobilized for the task, so that the program shapes up as a business builder of great potential for many industries. It will take some time for the program to get into full swing, of course, and peak levels will probably not be attained until about 1960. However, by that time the total of all highway construction expenditures in this country is expected to be running at about $8 billion, whereas this year such expenditures will probably exceed $5 billion by only a relatively small margin.

• • •

Douglas Sales Up in Half But Earnings Off Slightly

Increased sales, but a slight dip in earnings resulting from heavier development write-offs, were reported by Douglas Aircraft Co. for the first half of fiscal 1956. Sales for the six months ended May 31 totaled $453,076,740. Net earnings, after deduction for estimated taxes, amounted to $12,820,637.



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UNITED STATES STEEL

THESE seven-ton bulldozers are truly research tools, for they are taking part in an exhaustive program for the study and revision of accepted methods of oscillographic recording system design and manufacture.

Yes, Sanborn Company is on the move! The instruments above are levelling off small mountains of earth and rock in preparation for a new and modern Sanborn plant near Boston, Mass.

Completion of the structure late this year will mean vastly improved facilities for research, manufacturing and other operations. This will directly and immediately benefit not only the work Sanborn does, but also the people who use Sanborn systems, amplifiers, recorders and other components. It will make possible more rapid development and production of new instruments, and increased opportunity for a larger number of people to apply their skills to the problems of modern instrument design and manufacture.

This represents not "just a new plant", but a reflection of Sanborn's growing role in providing better answers to industry's oscillographic recording needs.

Sanborn Company, Industrial Division, Cambridge 39, Mass.

Scale model of new Sanborn plant just off Route 128 in Waltham, Mass.

ORION

(*Continued from page* 59)

port design, mismatching of the turbine nozzle to the engine's total air demand, crankshaft phasing studies—and on and on. These problems can only be solved on a full sized engine.

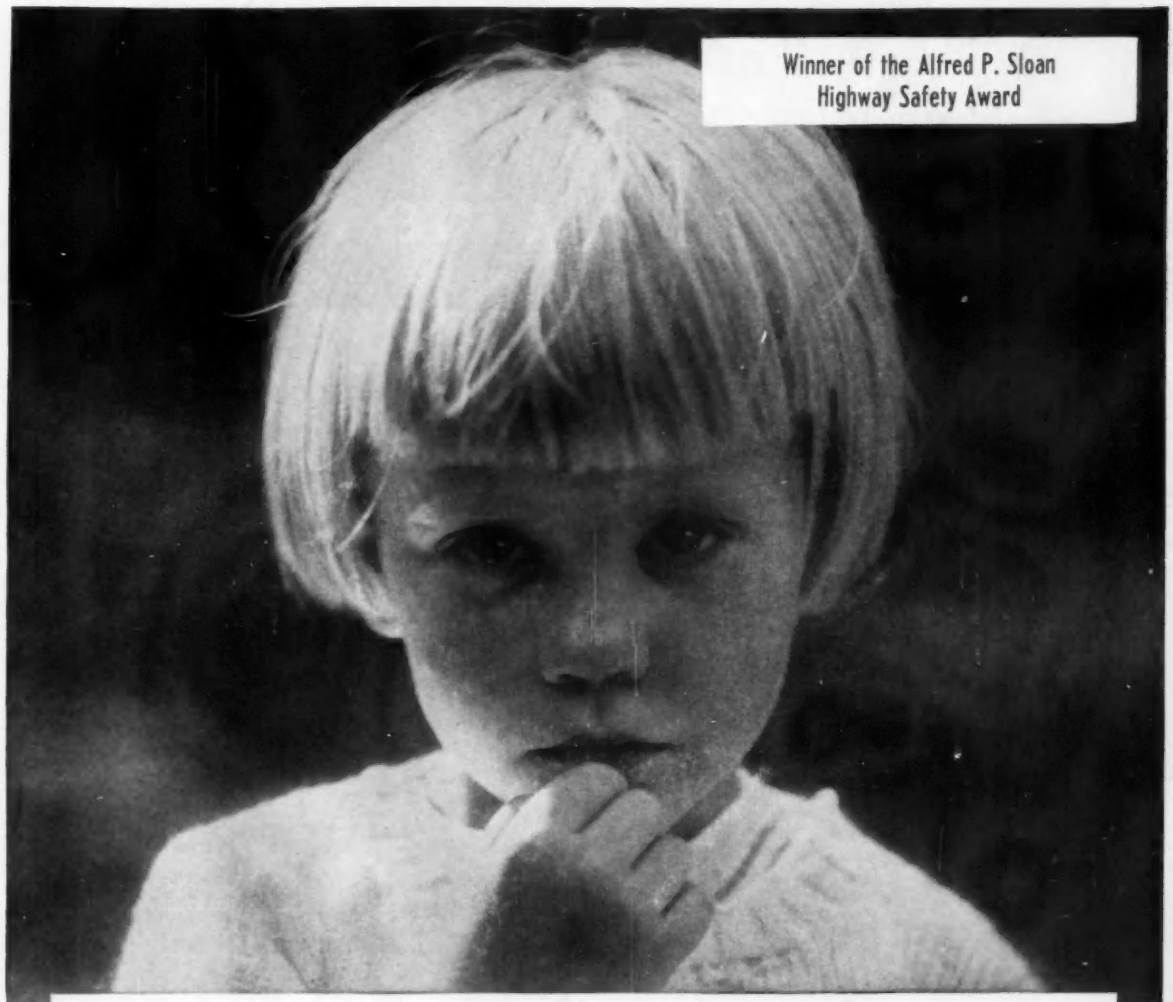
The O.P. (opposed piston) type of engine has a very high rating—and in addition the use of a supercharge pressure ratio of slightly over 2 meant that advantage could be taken of the high specific performance of the centrifugal compressor. Six hundred tshp requires 6 O.P. cylinders in length and while the performance "Factor of Merit" of such an engine was high it was found that by cutting the six cylinder O.P. engine in two and folding one half back over the other, the resulting package was of an acceptable rectangular dimension and no larger in height than the compressor is in diameter. An artist's drawing of the Rigel engine is shown here.

In essence, the Rigel engine is a rectangular package, approximately 35 in. high by 47 in. wide by 67 in. long, consisting of two rows of three horizontal cylinders, with four, three throw crankshafts all geared together. On one end are the two centrifugal compressors. These are driven from the gear train that ties all four crankshafts together. On the opposite end of the engine is the power turbine. The discharge from the two air compressors enters their respective conduits, flows through the cylinders and into the turbine. The turbine is mechanically free from the gas generator proper, therefore its output in speed and torque are functions of the load only and are self-adjusting in accordance with the gas flow from the gas generator. Hot gas flow from the gas generator is a unique function of throttle setting.

The connecting rod construction permits squeezing two cylinder rows together approximately three inches. This is the result of saving two bolt boss dimensions on the two rods that are bound to roll together on some one of the twelve crank throws. The crankshafts are built up of sections bolted together with Gleason Curvic face splines transmitting the torque. The bolt tension produces a compression load on the spline teeth of sufficient force to withstand the bending moments.

The two fuel nozzles shown extending at an angle to each other from the center of each cylinder (in the illustration) have, since this drawing

(*Turn to page* 132, *please*)



"My name is Mary Lou.
I live at 916 Indian Road.
I am a good girl. I never, never play in the street.
Naughty girls play in the street so please drive carefully.
Even naughty girls are too young to have to go to heaven.
Watch out for naughty girls because sometimes even good little girls are naughty.
Please drive carefully."

The above message is brought to you in the interest of safer driving by Auto Specialties Mfg. Co. of Saint Joseph, Michigan, where we raise a lot of good little girls who sometimes run into the street and, incidentally, where we manufacture safer automobile brakes . . . Auto Specialties Double-Disc Brakes. They are ready for cars now.

You can stop smoothly and in a straight line at high or low speeds with Auto Specialties Double-Disc Brakes.

In a "panic stop" your brakes won't cause you to swerve. You'll have a better chance to maintain control of your car when it's equipped with Double-Disc Brakes.

Their adoption will be in keeping with increased horsepower, speed and with the industry's continuing desire to give the American motorist better, safer and more pleasant means of transportation.

For more information on these brakes, a 16-page, 4 color, illustrated booklet is available free. Write for "The Stopping Story." *And if you're driving today, watch out for Mary Lou.*

AUTO SPECIALTIES MFG. CO., INC. Saint Joseph, Michigan

Plants also at Benton Harbor and Hartford, Michigan and Windsor, Ontario, Canada
Manufacturing for the automotive and farm machinery industries since 1908

Spicer has supplied for a wide range of

Your need + Dana skill and engineering = the right axle for the job!

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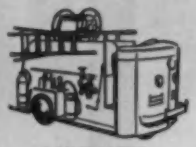
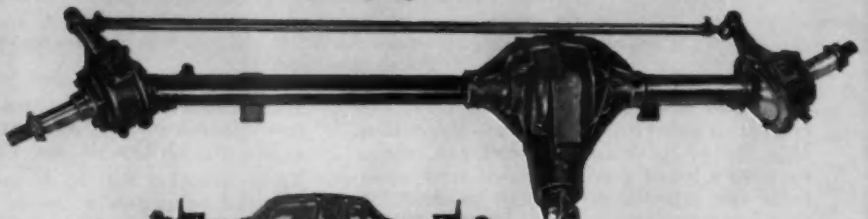
LIFT TRUCK



FIRE FIGHTER



SPORTS CAR

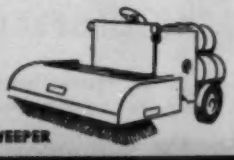
GOLF CART

A FEW TYPICAL SPICER-BUILT AXLES . . .

and a few of the many different types of vehicl • in which they are being used.

MOTOR SCOOTER

LIGHT TRUCK



POWER SWEEPER

DANA CORPORATION · Toledo 1, Ohio

MILLIONS OF AXLES

Power Driving Needs!

Spicer has over 50 years of power-transmission experience . . . has the most diversified corps of engineers in the industry . . . and has the industry's largest group of production facilities.

Spicer can design and manufacture axles for ANY type of light- and medium-duty motor-driven vehicle you produce!

Spicer experience includes a wide range of axles for units such as:

- Light and Medium Duty Trucks
- Passenger Cars
- Road Markers
- Power Sweepers
- Golf Carts
- Motor Scooters
- 4-Wheel Drive Trucks
- Mine Cars
- Fire Fighters
- Lift Trucks
- Self-Propelled Agricultural Vehicles
- Small Delivery Trucks

and many other specialized types of vehicles.

Write for Spicer Axle Engineering Bulletin No. 364, and ask for an engineering conference on your particular axle requirements. We can supply your needs—*quickly and efficiently!*

600,000 sq. ft. of production facilities at Fort Wayne Axle Division . . . one of the 10 modern plants operated by the Dana Corporation.

The Fort Wayne Axle Division is equipped with the most modern and efficient production systems, capable of producing thousands of axles daily.

ALSO CASES, SHAFTS AND GEARS

FOUR WHEEL DRIVE TRUCK

ROAD MARKER

PASSENGER CAR

Spicer

SPICER PRODUCTS: TRANSMISSIONS • UNIVERSAL JOINTS • PROPELLER SHAFTS • AXLES • TORQUE CONVERTERS • GEAR BOXES • POWER TAKE-OFFS • POWER TAKE-OFF JOINTS • RAIL CAR DRIVES • RAILWAY GENERATOR DRIVES • STAMPINGS • SPICER and AUBURN CLUTCHES • PARISH FRAMES • SPICER FRAMES

AXLES ALSO MANUFACTURED IN CANADA BY HAYES STEEL PRODUCTS LIMITED, MERRITTON, ONTARIO

(*Continued from page* 128)
was made, been replaced by one single nozzle, and the six fuel pump discharge fittings were reduced to three. It will be noticed that the exhaust ports are in evidence on the right hand end of the upper row while the exhaust ports are to the left-hand end on the lower row. This cylinder arrangement assures a more even temperature distribution and reduces frame distortion.

The foregoing article is an abstract of a paper presented at the SAE National West Coast Meeting held in San Francisco, August 6-8.

More Government Contract Awards

THIS latest list of Government prime contracts that have been awarded covers the period from June 26 to July 27, 1956. Items included in this list are for various types of automotive military equipment, including tanks, motorized gun carriages, trucks, airplanes, automotive components and spare parts, automotive maintenance equipment, etc.

ACF INDUSTRIES, Erco Div., Hyattsville, Maryland
Trailer, bomb—110 ea.—$211,895

ACTIVE GEAR COMPANY, INC., Chicago, Illinois
Shaft, propeller, front — 4794 ea. — $52,110

AEROQUIP CORPORATION, Jackson, Michigan
Coupling—23 items—$92,849

AIR ASSOCIATED, INC., Teterboro, New Jersey
Cowl flap actuators—various—$1,138,952

AIRCRAFT SUPPLIES, Nutley, New Jersey
Spare parts for engines—$362,744

AIRESEARCH MANUFACTURING CO., Div of The Garrett Corp., Los Angeles, Calif.
Tube oil cooler—2 items—$351,219
Drive assemblies—40 ea.—$720,000

AIRESEARCH MANUFACTURING CO. OF ARIZONA, Phoenix, Arizona
Air turbine starters—1472—$885,040
Gas turbine compressors — 650 — $11,536,189
Starters, pneumatic—745—$970,915

ALCO PRODUCTS, INC., Schenectady, New York
Spare parts for tanks and other vehicles —1651 ea.—$64,191

ALLIS-CHALMERS MANUFACTURING CO., Milwaukee, Wis.
Crawler, tractors—2 ea.—$22,105

AMERICAN BOSCH ARMA CORP., Arma Div., Garden City, New York
Facilities in support of WS-107A program—$1,100,000

AMERICAN LA FRANCE CORP., Elmira, New York
Parts—433 ea.—$29,560

AMERICAN MOTORS CORP., Special Products Div., Detroit, Michigan
Tool sets, maintenance—$84,727

AVCO MANUFACTURING CORP., Lycoming Div., Stratford, Conn.
R-1820-84 engine—$4,296,075
Design study of shaft turbine aircraft engine—$59,113
R1300-3A engines—$1,754,368
R1820-84 engine, R1820-82 engine, and R1300-4 engine—$1,812,358

THE B. G. CORP., Ridgefield, New Jersey
Spark plug—10,160 ea.—$31,496

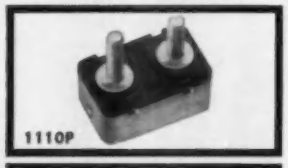
THE BAKER-RAULANG CO., Cleveland, Ohio
Trucks, fork lift—107—$370,027

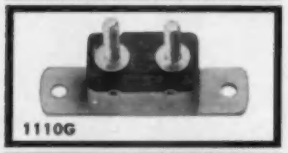
BEECH AIRCRAFT CORP., Wichita, Kansas
Tank assy.; pinion and gear assy.; cable assy.—451—$94,749
Propeller hub gear assy. — 213 ea. — $39,959
Servicing units for aircraft—$2,020,584
Generator set type MD-3—1151 ea.—$9,812,516

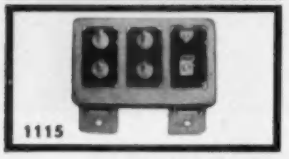
BELL AIRCRAFT CORP., Texas Div., Fort Worth, Texas
Parts for HTL spares—various—$42,490

(*Turn to page* 134, *please*)

FASCO
AUTOMOTIVE RESET CIRCUIT BREAKERS
Stop Trouble Before It Starts!







Yes, these FASCO circuit-breakers protect against overloads and shorts instantly . . . automatically . . . unfailingly . . . thus safeguarding low-voltage electrical equipment operation. And they're available in 8, 10, 15, 20, 25 or 30 ampere capacities . . . for mounting in 1, 2, 3, 4 or 8-unit FASCO brackets.

FASCO Automatic Reset Circuit Breakers are another example of how wise it is to

CONSULT FASCO *. . . FIRST!*

AUTOMOTIVE DIVISION
FASCO
INDUSTRIES, INC.
ROCHESTER 2, NEW YORK
DETROIT OFFICE—12737 PURITAN—PHONE: UN 17476

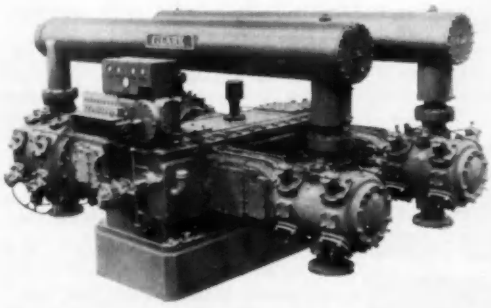
any flat means trouble

but in plant air supply it also means lost production!

Unless your plant air supply has adequate capacity in reserve, you may actually slow down your entire production every time you add a new labor-saving air-operated tool or device.

New increased demands on overloaded or overextended air supply inevitably cause a pressure drop all along the line. That means every tool, chuck and wrench slows down . . . and production suffers.

When did you last check your air at the *end* of the line? If it is going "flat," a Clark Balanced/Opposed Air Compressor will restore full pressure and, at the same time, *provide for a planned reserve to take care of future demand.*



There is a Clark Representative near you ready to give you all the facts. Why not call him now or write for your copy of Bulletin 118?

CLARK BROS. CO., OLEAN, N. Y.
One of the Dresser Industries
Offices in principal cities throughout the world

CLARK®

Balanced
Opposed
Compressors

(*Continued from page* 132)

BENDIX AVIATION CORP., South Bend, Indiana
Kit, repair hydraulic cylinder—$572—$87,827
Carburetor assy.—2442—$374,408
Cylinder assy., power brakes—771—$26,311
Wheel assemblies, brake assys.—$2,875,666
Brake assemblies—$266,638
Spare parts for F-86-D wheel and brake—$1,087,930

BENDIX AVIATION CORP., Montrose Div., South Montrose, Pa.
Pilot production of miniature synchros—$1,088,114

BENDIX AVIATION CORP., Pioneer-Central Div., Davenport, Iowa
Transmitter, rate of flow, fuel—1054 ea.—$277,454
Speed indicators—$424,829

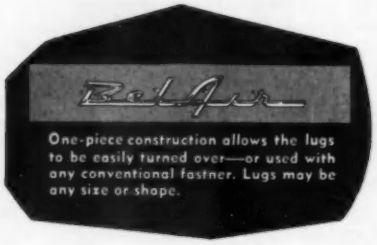
BENDIX AVIATION CORP., Red Bank Div., Eatontown, New Jersey
Generators, aircraft,—$289,979
Generator assemblies—306 ea.—$59,507
Inverters—$82,247

BENDIX AVIATION CORP., Scintilla Div., Sidney, New York
Kit, ignition analyzer—213—$252,405

BENDIX AVIATION CORP., Utica Div., Utica, New York
Starters, electric; pack assemblies, clutch—758—$51,971
Valve sub assembly de-icer valve—31 items—$106,676

Kolfor
COINED WITH LUG
— OF ALUMINUM —
Back View
One piece aluminum construction. Lug is cold forged from plate, making the lug and plate one integral unit.

EXCLUSIVE
Kolfor PROCESS
turns ideas into reality


Bel Air
One-piece construction allows the lugs to be easily turned over—or used with any conventional fastner. Lugs may be any size or shape.

Exciting style in automobile Trim and Parts achieved by KOLFOR one-piece letters, emblems and script plates . . . anodized in any brilliant color. No other process till now could do this so economically.

To help you transform your design ideas into practical production items, we can create and then produce for you exciting style in Trim and Parts thru our many processes and engineering-design services. Your inquiry is invited.

ELECTRO-CHEMICAL ENGRAVING CO., INC.
1102 Brook Avenue, New York 56, N. Y.

Write to:
ETCHED PRODUCTS CORPORATION
39-01 Queens Boulevard, Long Island City 4, N. Y.

Rolbos — roller embossing (including "stop-roll") **Fmbos** — mechanical embossing
Etchrite — sharp etching **Kolfor** — cold forged coined letters with integral lug
Lithographing * Stamping * Anodizing * Plating * Enameling Working in All Metals

Air turbine starter—211 ea.—$223,663
Starters, aircraft—$31,305
Starter, combustion; air bottles; shut-off valves—20—$96,174

BOEING AIRPLANE CO., Washington, D. C.
Test turbine components—$60,000

BOEING AIRPLANE CO., Wichita, Kansas
Aircraft maintenance handbooks—job—$471,842
Trainers—$151,631
Facilities for B-52—$935,000

BOEING AIRPLANE COMPANY, Industrial Products Div., Seattle, Wash.
Model specifications for YT60-B0-2 engine; design, XT60-B0-2 engines—$354,443
Gas turbine driven air compressor—20—$564,724
Facilities for navigational and radar systems—$535,000
Facilities for production and testing of B-52 aircraft—$983,000
Facilities for Momarc—$4,250,000

BORG-WARNER CORP., Byron Jackson Div., Pasadena, Calif.
Signal generators—302 ea.—$1,133,348

BORG-WARNER CORP., Mechanical Universal Joint Div., Rockford, Ill.
Shaft assy.—737—$40,233

BORG WARNER CO., Pesco Products Div., Bedford, Ohio
Motors—various—$35,508
Parts for pump assys.—various—$64,775
Parts for pumps—various—$37,027

CANADIAN COMMERCIAL CORP., Washington, D. C.
L-20A airplanes—$2,169,613

CATERPILLAR TRACTOR CO., Peoria, Illinois
Tractors, scrapers—14 ea.—$211,670

CENTRAL FIRE TRUCK CORP., St. Louis, Missouri
Truck, fire—23 ea.—$237,302

CHECKER CAB MANUFACTURING CO., Kalamazoo, Michigan
Trailer, cargo, 11/2 ton, 2 wheel—571 ea.—$511,593

CHRYSLER CORP., Detroit, Michigan
Spare parts—14,713—$201,181
Publication for M48A2 tank—$488,250

CLARK EQUIPMENT Co., Benton Harbor, Michigan
Truck, straddle—93 ea.—$1,667,288

CLARK EQUIPMENT CO. Jackson, Michigan
Engine assembly—5 items—$152,098

CONTINENTAL AVIATION AND ENGINEERING CORP., Detroit, Mich.
J-69-T-19A engines—$787,600
Development of V-12, multi-fuel air-cooled engine—$457,000
Design and manufacture of a model AH-760 engine—$244,500
Design study of shaft turbine aircraft engine—$52,308
YJ69-T-17 engines—$255,704
Facilities for gas turbine compressors—$1,500,000

CONTINENTAL MOTORS CORP., Detroit. Michigan
Fabrication, test and delivery of four ½ hp and four 3 hp engines—$70,023

CONTINENTAL MOTORS CORP., Muskegon, Mich.
PE 200-2 Packette engine—$249,920
Pe 150-6 Packette engine—$499,493
Engine modification—various—$133,316
Facilities—$106,000
Tank spare parts—4600—$165,784
FS0-470-A engines—$126,277

COOPER TIRE AND RUBBER CO., Findlay, Ohio
Tire, truck and bus—2970 ea.—$73,805

(*Turn to page* 136, *please*)

(Advertisement)

R B & W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

What's the right torque for bolts?

This is one of the toughest questions we're asked. Too many variable conditions. But the following may help.

The bolt takes two stresses during wrenching: (1) Torsion, (2) Tension. Tension is what you want. Torsion is the necessary evil due to friction. Probably 90% of applied torque goes to overcome friction.

With the friction factor changed by lubrication, plating, etc., the torque needed to produce a given tension is hard to predict. However, a useful empirical formula exists for *normal* friction conditions.

Inch-lbs. Torque = 0.2 x bolt diameter x bolt tension

Many tests show that the 0.2 torque coefficient is approximately constant for the usual friction conditions, for all diameters, and for both coarse and fine thread. Average deviation is about 7%. But when are conditions *"normal"?* The only *sure* way to check torque is to set up a pilot assembly and try it out.

In pilot testing for rigid joints, tighten a few bolts with torque wrench to failure, and then set torque at 75% of that load; or even at yield strength, since torsion component vanishes leaving bolt under tension only, which is well below ultimate strength.

We've worked up curves giving suggested torques for various size bolts. Send for a copy.

How to make a stronger joint

From research on structural steel joined with high strength bolts come facts applicable to *products:*

These bolts can be torqued to high tension for a large clamping force on joined members. Resultant friction overcomes shearing forces and prevents slippage. The higher compressive forces also protect bolt holes from fatigue cracks. Moreover, the tighter the bolt, the less chance for loosening, and the less risk of bolt fatigue due to dynamic loading.

High strength bolts are stronger in shear, too. In recent tests, rivets and "soft" bolts broke under extreme shear load; but high strength bolts didn't—the joined steel failed first.

APPLYING THE ADVANTAGES

Since high strength bolts have 2 to 3 times more tightening strength than common bolts, smaller diameter bolts can be used. As discussed above, these make a stronger joint; also weigh and cost less.

Along with good joint design, it's important that fasteners used can meet requirements. For example: A manufacturer designed vibrating machinery for high tensile bolts, but it was assembled with low carbon bolts. Joints failed. RB&W high carbon bolts with hardened washers solved the problem.

Moral: *Specify* even your standard fasteners.

RB&W selects the proper grade of steel to give "Empire" high strength fasteners the precise balance between *tensile strength* and *ductility.*

Feel free to call on RB&W for help in selection and use of standard, low cost fasteners.

Three radial dashes on bolt head denote a high strength bolt. The "E" identifies Empire bolts, an RB&W trademark. These markings assure highest quality standard fasteners with full strength, and uniformity of size and physicals.

●

Russell, Burdsall & Ward Bolt and Nut Company . . . plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

Silicon bronze fasteners combine desirable features

Silicon bronze offers the highest conductivity of fasteners able to withstand high stresses. It resists corrosion, stays free from season cracking, too. It makes ideal fasteners for electrical use where tensile strength is important; or for corrosive environments.

One of the first to develop such fasteners, RB&W cold works them for tensile strength and for clean, well formed threads that don't seize. Oval bolts, hex bolts and nuts and U bolts available. Specials can be developed.

MACHINABILITY INDEX 80-90*

PEARLITIC MALLEABLE CASTINGS

*B1112 STEEL = 100

Low machinability index of 80-90 (B1112 steel = 100) is probably reason enough to warrant serious consideration for your product.

But pearlitic malleable castings—from National—don't stop there. They have great ultimate strength . . . resist wear under heavy loads at high speeds . . . make excellent non-seizing bearings . . . can be air or liquid-quenched . . . can be smooth-finished.

Don't overlook the advantages of pearlitic malleable. For pearlitic malleable castings—from National—can often reduce manufacturing costs, weight and assembly time . . . can increase the sales potential of your product. AA-1806

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

(*Continued from page* 134)

CURTISS-WRIGHT CORP., Caldwell, New Jersey
Repair, modification electric propeller assys.—$265,000
Propeller assembly—$89,687
Synchronizer assembly — 279 ea. — $903,627
Propeller assembly, spare blade assembly—$705,999

CURTISS-WRIGHT CORP., Wright Aeronautical Div., Wood-Ridge, New Jersey
Laboratory and test equipment — $2,782,000

DART TRUCK CO., Kansas City, Missouri
Modification—6 snowplows—$287,565 est.
Design and fabrication of one 12½ ton and one 20 ton crane carrier—$88,191

JOHN DEERE DUBUQUE TRACTOR WORKS of Deere Manufacturing Co. of Iowa, Dubuque, Iowa
Tractor, wheel—95 ea.—$156,136

DETROIT BEVEL GEAR CO., Detroit, Michigan
Shaft, propeller, front—5096 ea.—$57,330

DIAMOND T. MOTOR TRUCK SALES, Washington, D. C.
Trucks—10—$64,660

DORSEY TRAILERS, INC., Elba, Alabama
Pilot model semitrailers, tank, transporter—job—$167,615
Semitrailer, cargo, 12 ton — 3012 — $11,581,210
Semitrailer—60—$239,521

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif.
Parts for R6D a/c—various—$119,737
Pods—$172,298

DOUGLAS AIRCRAFT CO., INC., Long Beach, Calif.
Fabrication of trainer and modification of 2 trainers—$41,016

DOUGLAS AIRCRAFT CORP., Tulsa, Oklahoma
Additional facilities—$175,000
Additional facilities for B-47 IRAN modification—$175,000
Facilities—$6,745,000

EATON MANUFACTURING CO., Aircraft Div., Battle Creek, Mich.
Machinery and equipment for blades—$1,500,000

ELASTIC STOP NUT CORP. OF AMERICA, Elizabeth, New Jersey
Test set-air field lighting systems—250 ea.—$572,812

ELASTIC STOP NUT CORP. OF AMERICA, Union, New Jersey
Nut—7,100,000—$104,000

ELECTRIC AUTO LITE CO., Toledo, Ohio
Starter assembly—$91,420
Armature, starter—$45,609
Generator, assembly—$347,840
Gage pressure, hydraulic—$45,559

ELECTRIC STORAGE BATTERY CO., Willard Storage Battery Div., Cleveland, Ohio
Battery—$340,340

EX-CELL-O CORP., Lima, Ohio
Facilities for J-57 engine components—$1,500,000

FAIRCHILD ENGINE & AIRPLANE CORP., Stratos Div., Manhattan Beach, Calif.
Parts for A/C—various—$40,408

FAIRCHILD ENGINE AND AIRPLANE CORP., Hagerstown, Maryland
Facilities—$33,000
Trainers for C-123-MTU and C-119-MTUs—$133,051

FARGO MOTOR CORP., Washington, D. C.
Automobiles—38 ea.—$51,957
Trucks—4 ea.—$14,742
Light trucks—18 ea.—$28,453

(*Turn to page* 140, *please*)

"Two Clark planetary axles make this truck an ideal drift-bucker"

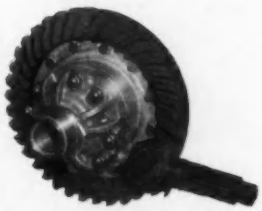
. . . . . Hydro-Quebec

For transporting equipment cross-country, through northern Quebec's heavy snows to a new power development, Hydro-Quebec converted trucks of conventional type to four-wheel drive by installing Clark Power Trains—torque converter, transmission and two Clark planetary axles, one steering and the other non-steering. "Excellent equipment—doing a great job," says Hydro-Quebec.

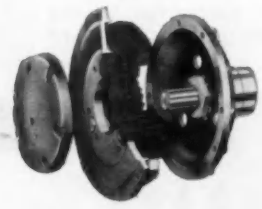
Clark's planetary axle has established an extraordinary performance record in extremes of punishing service—a record high-lighted by the virtual elimination of broken axle shafts.

In this revolutionary axle 70 percent of the driving torque is transferred to the planetary assembly in the drive-wheel—in contrast to conventional design, in which the full torque load is delivered directly to the axle shafts. Shaft wind-up and surge are practically eliminated, and broken shafts virtually unknown. Power flows smoothly—no chatter, no "digging" in soft ground. Also, by means of better torque-load distribution, this axle combines maximum rugged strength with minimum size and weight.

Are you looking for ways to improve your machines?—to get more work done? Get acquainted with this new axle that outlaws broken shafts. A helpful bulletin provides full information—use the coupon.



Primary Reduction in the center section, by helical bevel pinion and gear.



Second Reduction in the drive wheel—a sun gear splined to the axle shaft and three planet gears driving an internal gear in the inner periphery of the wheel, as close as possible to the point where tractive effort is applied. Two types: steering and non-steering.

CLARK EQUIPMENT COMPANY • AXLE DIVISION, Buchanan 2, Michigan

CLARK® EQUIPMENT

Please send illustrated bulletin on the Clark Planetary Axle.

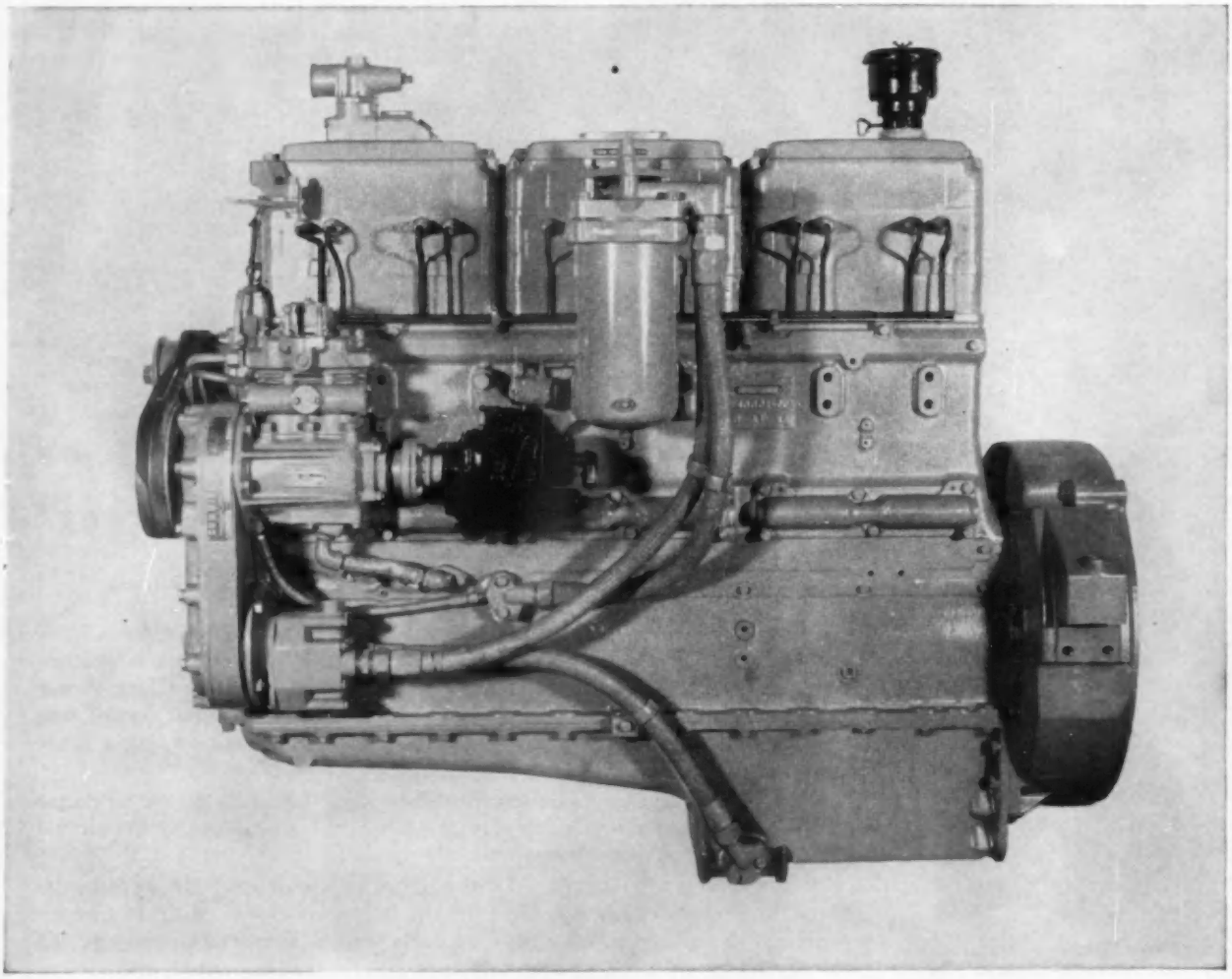
Name_____ Position_____

Firm_____

Address_____

City_____ State_____

Moving an iron mountain, rely on lifelines



Powerful, rugged Cummins Diesel model HRB-600 is one of a complete line of Cummins diesels ranging from 60 to 600 hp. Bundyweld Steel Tubing fuel injector lines, indicated here in natural copper, provide leakproof performance, withstand vibration in all kinds of service.

BUNDYWELD IS DOUBLE-WALLED FROM A SINGLE STRIP

Bundyweld starts as a single strip of copper-coated steel. Then it's . . .

continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Copper coating fuses with steel. Result . . .

Bundyweld, double-walled and brazed through 360° of wall contact.

←

NOTE the exclusive Bundy-developed beveled edges, which afford a smoother joint, absence of bead, and less chance for any leakage.

Cummins Diesels of Bundyweld Tubing

These 30-cubic-yard Mack trucks are part of a fleet of 24 that haul 5,000,000 long tons of ore a year from Cerro Bolivar, Venezuela's mountain of iron. Cummins Diesels, used by the entire fleet, rely on vital fuel lifelines of Bundyweld Steel Tubing.

Another example of the way double-walled Bundyweld steel tubing provides leakproof, dependable performance in the most difficult applications

Cummins Engine Company, Inc., of Columbus, Indiana, world's leading independent producer of high-speed, light-weight diesels, is known the world over for engines of rugged durability. To protect this reputation, Cummins specifies Bundyweld Steel Tubing for vital fuel lifelines.

Manufacturers like Cummins choose Bundyweld because it is the only steel tubing that is double-walled from a single metal strip, copper-bonded through 360° of double-walled contact. They know too, that Bundyweld Tubing is leakproof; thinner-walled, yet stronger; has high bursting strength; and is remarkably resistant to vibration fatigue.

But high quality is only one of the big advantages you get with Bundyweld Tubing. Others are: expert engineering service, modern fabrication facilities, and prompt, on-schedule deliveries. For more information write, wire, or phone us, today!

BUNDY TUBING COMPANY, DETROIT 14, MICHIGAN

BUNDYWELD® TUBING

Bundy Tubing Distributors and Representatives: ***Cambridge 42, Mass.:*** Austin-Hastings Co., Inc., 226 Binney St. • ***Chattanooga 2, Tenn.:*** Peirson-Deakins Co., 823-824 Chattanooga Bank Bldg. • ***Chicago 32, Ill.:*** Lapham-Hickey Co., 3333 W. 47th Place • ***Elizabeth, New Jersey:*** A. B. Murray Co., Inc., Post Office Box 476 • ***Los Angeles 58, Calif.:*** Tubesales, 5400 Alcoa Ave. • ***Philadelphia 3, Penn.:*** Rutan & Co., 1717 Sansom St. • ***San Francisco 10, Calif.:*** Pacific Metals Co., Ltd., 3100 19th St. • ***Seattle 4, Wash.:*** Eagle Metals Co., 4755 First Ave., South ***Toronto 5, Ontario, Canada:*** Alloy Metal Sales, Ltd., 181 Fleet St., E. • **Bundyweld nickel and Monel tubing are sold by distributors of nickel and nickel alloys in principal cities.**

WORLD'S LARGEST PRODUCER OF SMALL-DIAMETER TUBING • AFFILIATED PLANTS IN AUSTRALIA, ENGLAND, FRANCE, GERMANY, AND ITALY

(*Continued from page* 136)

FARGO MOTOR CORP., Highland Park, Michigan
Truck, ¾ ton, telephone — 41 ea. — $89,404
Truck, panel delivery—414 ea.—$471,458
Truck, tank; truck tank, sprinkler; truck, van; truck, stake and platform; truck, tractor; truck, dump — 195 — $1,290,926
Truck, stake and platform; truck, dump, 1½ ton; truck, dump, 2 ton; truck, tank; truck, van; truck, wrecker—1119—$2,370,250
Truck, maintenance; truck, pickup, 1 ton, 4 x 4—30—$66,644

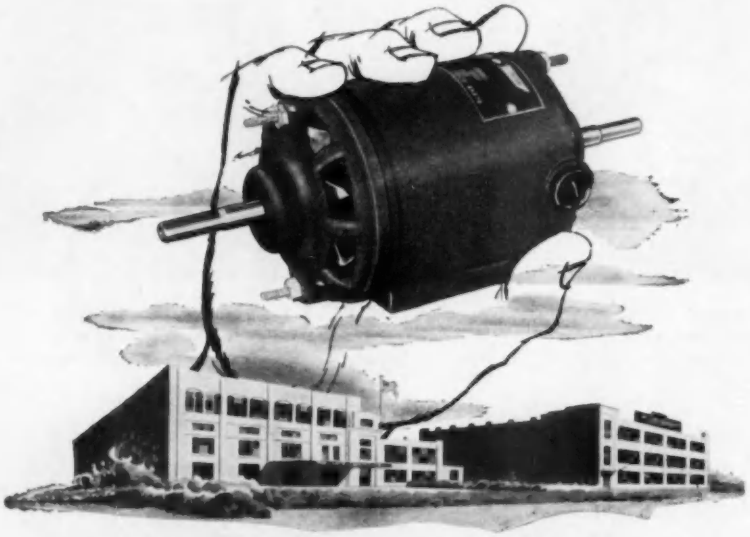
FIRE MASTER CORP., Mt. Clemens, Michigan
Fire truck—1 ea.—$16,960

FIRESTONE INDUSTRIAL PRODUCTS CO., Div. of The Firestone Tire & Rubber Co., Akron, Ohio
Disk, with tire assy.—$53,134

FIRESTONE TIRE & RUBBER CO., Los Angeles, Calif.
Engineering services—$300,000
Spare parts for missile—$63,751

FOOD MACHINERY & CHEMICAL CORP., San Jose, Calif.
Carrier, full-tracked, armored, M59—290 ea.—$8,368,820
Mortar, S. P., full tracked—450 ea.—$14,032,350
Arm, rear suspension—various—$63,203

FORD MOTOR CO., Ford Div., Washington, D. C.
Automobiles—241—$355,880
Light trucks—261—$290,395
Trucks—121—$280,747



CUSTOM-BUILT USE-ABILITY...
for your motor-driven products

Exceptional performance and dependability go with useability in Lamb Electric Motors because they are:

(1) "tailored" to the exact requirements of an application.

(2) built of quality materials by precision-minded personnel.

Our company is equipped and organized to *custom-manufacture on a volume basis;* hence high quality and controlled costs go hand-in-hand.

We would like to discuss these advantages with you for *your* new and redesigned products.

THE LAMB ELECTRIC COMPANY • KENT, OHIO
In Canada: Lamb Electric—Division of Sangamo Company Ltd.—Leaside, Ontario

Lamb Electric
SPECIAL APPLICATION FRACTIONAL HORSEPOWER **MOTORS**

FORD MOTOR CO., Dearborn, Mich.
Study for producing tank, 90MM gun, M48—$487,000
Design and development of utility ¾ ton, 6 x 6, XM-408—$649,314
Facility of T-96 tank—$64,200

FORD MOTOR CO., Ford Div., Livonia, Michigan
Truck, tank; truck, tractor; truck, van —81—$351,581

FORD MOTOR CO., Detroit, Michigan
Machinery and equipment—$7,082,000

GAR WOOD INDUSTRIES, INC., Wayne, Michigan
Truck, bomb service—115 ea.—$1,085,218

GENERAL DYNAMICS CORP., Convair Div., San Diego, Calif.
Flight test of F-102A aircraft — $2,441,000

GENERAL DYNAMICS CORP., Fort Worth, Texas
Facilities—$61,000
Additional facilities for B-58—$308,000

GENERAL ELECTRIC CO., West Lynn, Mass.
Machinery and equipment—$500,000

GENERAL ELECTRIC CO., Evendale, Ohio
Facilities—$5,133,674
Machinery and equipment—$5,125,000

GENERAL ELECTRIC CO., Erie, Pa.
Generator, aircraft—$59,548

GENERAL MOTORS CORP., AC Spark Plug Div., Flint, Michigan
Spark plug—76,392—$113,679
Modification kits for bombing navigational systems—$237,532
Switch, sensitive—100 ea.—$59,287
Bombing navigational computers — $14,522,501
Layaway—$409,112
Spare parts T-38 system — 608 ea. — $46,140
Spare parts—3598 ea.—$32,811

GENERAL MOTORS CORP., AC Spark Plug Div., Wayne, Michigan
Replenishment spare parts T38 fire control—various—$882,571

GENERAL MOTORS CORP., AC Spark Plug Div., Milwaukee, Wis.
Amplifier assemblies and other spare parts for bombing navigational systems—$1,111,129
Clutch assembly, motor, network and plate assembly, for bombing navigational systems—$1,197,260
Rotor and mirror assy.; caging assy.; 1444 glass, and other parts for bomb sights—$85,250
Modification kits for retrofit of A-1A BNC system—$119,322
Modification kits for K system BNC—$936,146
Modification kits for A-1A and B-2A BNC systems—$421,701

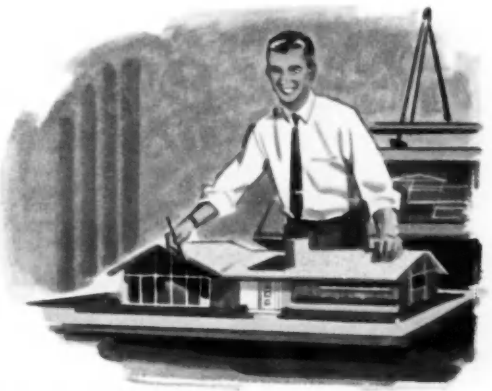
GENERAL MOTORS CORP., Allison Div., Indianapolis, Ind.
Spare parts for aircraft metering system—$72,001
Cover assy. end, with flange and brakes —560 ea.—$760,760
Gage design work—$201,717
Fabricate, build and test transmissions and final drives—7 sets—$275,000
Repair, maintain and minor modifications of transmissions — various — $50,000
Research and development of transmissions—$303,025

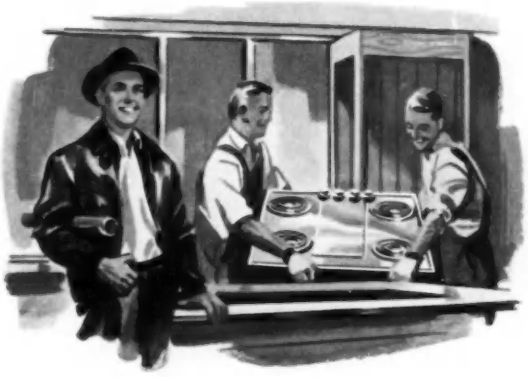
GENERAL MOTORS CORP., Allison Div., Aeroproducts Operations, Dayton, Ohio
Hubs—70 ea.—$250,250

GENERAL MOTORS CORP., Buick Motor Div., Flint, Michigan
Interim storage—$955,947

(*Turn to page* 143, *please*)

in the home everybody benefits from STAINLESS STEEL





THE ARCHITECT designs Stainless Steel into windows, kitchens, work surfaces, ovens and other important places because he knows there is nothing like Stainless for clean, lasting beauty.

THE BUILDER has had long experience with Stainless Steel. It's easy to install, does not chip or peel, and its beautiful finish presents no problem on matching or replacement.

the owner likes living with Stainless Steel. It's always gleaming and beautiful, cleans with a wipe, and lasts forever. And, to complement her kitchen she loves to own those shiny pots, pans, tableware, and appliances, all made of Stainless Steel.

McLOUTH STAINLESS STEEL

FOR THE PRODUCT YOU MAKE TODAY AND THE PRODUCT YOU PLAN FOR TOMORROW SPECIFY McLOUTH HIGH QUALITY SHEET AND STRIP STAINLESS STEEL

McLOUTH STEEL CORPORATION DETROIT, MICHIGAN • MANUFACTURERS OF STAINLESS AND CARBON STEELS

The Westinghouse Weld-O-Timer*
. . . with 3-minute plug-in panels

KEEPS DOWN TIME DOWN

The light weight and plug-in convenience of printed-circuit control panels on the new Weld-O-Timer could make the difference between high production and a long shutdown. In fact, three minutes is all you need to place and plug in all control panels—the heat-control panel, the weld sequence timer, and the weld and solenoid relays. The quick disconnect fasteners enable each panel to be quickly replaced or inspected. Industrial-type plugs and sockets assure fast, positive connections.

Everything about this new resistance welding control is designed for high production, product and personnel protection, and longer-lived dependability. For all the facts, call your Westinghouse sales engineer. Or write Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pa.

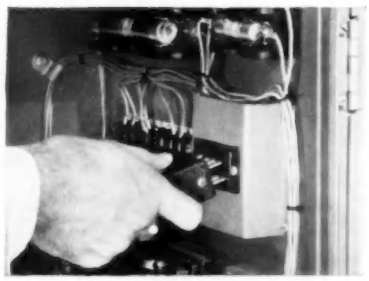
J-21946-A

*Trade-Mark

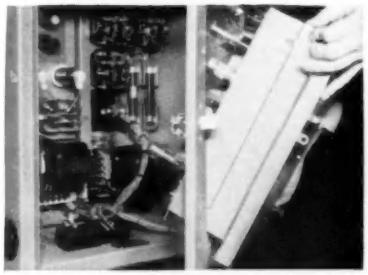
WATCH WESTINGHOUSE!

WHERE BIG THINGS ARE HAPPENING TODAY!

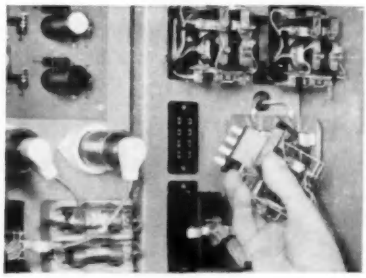
3:45 . . . Place heat control panel . . . secure with a quarter turn of the fastener.



3:46 . . . Plug in.



3:47 . . . Place weld sequence timer and plug in.



. . . Plug in relays.

3:48 . . . Control panels, weld and solenoid relays completely in place.

(*Continued from page* 140)

GENERAL MOTORS CORP., Cadillac Motor Car Div., Detroit, Mich.
Gun, twin, self-propelled, 40 mm M42A1—$22,815,000
Gage engineering agency services—$69,800
Light self-propelled weapons, M42 and T41—$465,000

GENERAL MOTORS CORP., Chevrolet Motor Div., Detroit, Michigan
Truck, ¾ ton—368 ea.—$461,564
Trucks—123—$182,637
Light trucks—517—$727,092
Automobiles—83 ea.—$110,010
Spare parts—1 lot—$33,980
Truck, pickup; truck, panel—21—$33,970
Truck, stake and platform—97 ea.—$236,416
Truck, pickup; truck, panel delivery—3739—$3,841,672
Truck, stake; truck, chassis; truck, dump; truck, stake—1719—$3,438,579

GENERAL MOTORS CORP., Cleveland Diesel Engine Div., Cleveland Ohio
Magnetic clutch, 250 KW Diesel, variable frequency generator set—1 ea.—$119,134
Parts for Diesel engines—2865 ea.—$97,259

GENERAL MOTORS CORP., Delco Products Div., Dayton, Ohio
Spare parts for electrical equipment—$44,040

GENERAL MOTORS CORP., Detroit Diesel Engine Div., Detroit, Mich.
Generator set, Diesel Engine driven—12 ea.—$235,054
Parts for Diesel engines—8775 ea.—$68,399

GENERAL MOTORS CORP., Fisher Body Div., Detroit, Mich.
Layaway and maintenance of tanks—$344,598

GENERAL MOTORS CORP., Foreign Dist. Div., New York, N. Y.
Light trucks—57—$82,396
Trucks—24 ea.—$34,166

GENERAL MOTORS CORP., GMC Truck & Coach Div., E. Pontiac, Mich.
Rescue trucks and tools—39 ea.—$340,379
Trucks—6 ea.—$18,755
Truck, stake and platform; truck, wrecker; truck chassis with cab—517—$1,314,984
Bus, 37 passenger—102 ea.—$563,988
Truck, tank; truck, chassis; truck chassis, with cab—188—$720,904
Spare parts—various—$473,202
Truck, wrecker—2 ea.—$32,982
Spare parts—28,032—$268,803

GENERAL MOTORS CORP., General Motors Technical Center, Detroit, Michigan
Combat and support vehicles—$350,000

GENERAL MOTORS CORP., Harrison Radiator Div., Lockport, New York
Cooler lub oil aircraft engine—2 items—$32,441

GENERAL MOTORS CORP., New Departure Div., Bristol, Conn.
Bearings—5500 ea.—$38,182

GENERAL MOTORS CORP., Oldsmobile Div., Lansing, Michigan
Layaway—$521,710

GENERAL MOTORS CORP., Pontiac Motor Div., Pontiac, Mich.
Guns, automatic, 20MM and spare parts—various—$4,507,596

GENERAL MOTORS CORP., United Motors Service Div., Detroit, Mich.
Parts—5288—$241,052

THE GENERAL TIRE AND RUBBER CO., Akron, Ohio
Wheel assys.—1194 ea.—$35,760
Brake assys.—$4,845,236

B. F. GOODRICH CO., B. F. Goodrich Tire & Equipment Div., Akron, Ohio
De-icer boots—various—$70,559

(*Turn to page* 144, *please*)

CASE HISTORY 1

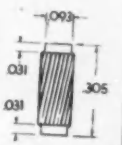
REQUIRED:
A dependable supply of this small, machined electrode to meet customer's quality and quantity needs at reduced cost.

HASSALL SOLUTION:
Hassall-designed re-heading process, involving no critical dimension changes, resulted in a 59% cost reduction to customer.

CASE HISTORY 36

REQUIRED:
Less costly manufacturing method for this small stainless steel fluted pin which cost $19.20 per M as a screw machine product.

HASSALL SOLUTION:
Cold forming by Hassall at a cost of $2.95 per M gave the customer an 85% cost reduction on this part.



SPECIALTY MANUFACTURER OFFERS SAVINGS ON SMALL PARTS AND FASTENERS

CASE HISTORY 89

REQUIRED:
Customer looking for low cost, high production rate method of producing mandrels for rotary dental brushes.

HASSALL SOLUTION:
Hassall-originated design for cold-heading replaced chamfered end with tumbled, round end; maintained rigid specifications for straightness and made low-cost production possible.

CASE HISTORY 37

REQUIRED:
Bumper bolt with banded rubber cap for license plate support.

HASSALL SOLUTION:
The large head on this bolt would ordinarily call for screw machining but the two lugs under the head ruled this out. Progressive cold-heading was Hassall's answer.

Multiply these case histories a thousandfold and you'll get some idea of the variety of tough problems we crack, and the savings we effect for our customers in the course of a year.

Our cold-heading process—supplemented by secondary operations—imposes amazingly few limitations on the parts and fasteners we can make. Don't forget that we are not limited to "stock" sizes. These illustrations show that Hassall—a specialty supplier—can show you substantial savings, better deliveries and technical assistance on your small parts and fasteners.

Proof? Send us your specifications or write for catalog.

John Hassall, Inc., P. O. Box 2194, Westbury, Long Island, New York.

HASSALL

SINCE 1850

NAILS, RIVETS, SCREWS AND OTHER COLD-HEADED FASTENERS AND SPECIALTIES

(*Continued from page* 143)

B. F. GOODRICH COMPANY, Akron, Ohio
Track, assembly rubber—$2,855,418
Wheel assy.—268 ea.—$228,839
Parts for R7V-1, WV-2, 3A/C—various—$56,097
De-icer boots—various—$39,992

THE B. F. GOODRICH CO., Dayton, Ohio
Wheel assemblies, brake assys.—$1,620,011

GOODYEAR AIRCRAFT CORP., Akron, Ohio
Rotor blades for helicopter—2—$46,946

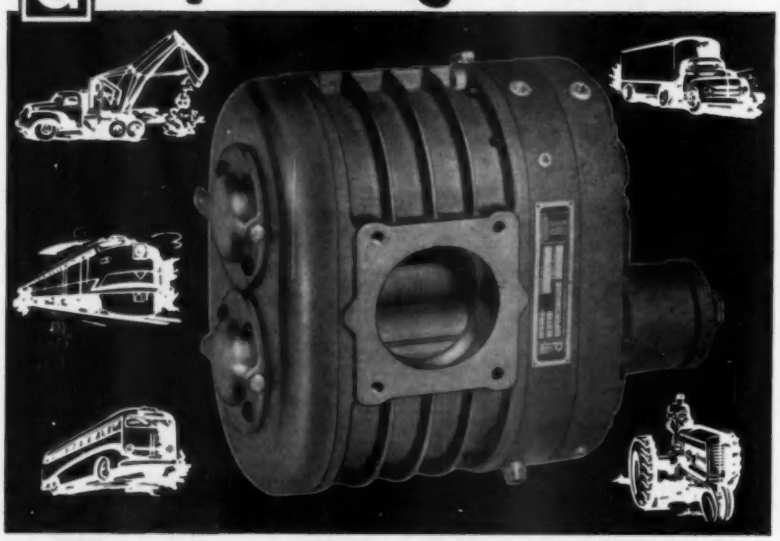
THE GOODYEAR TIRE & RUBBER CO., INC., Akron, Ohio
Lining, brake—46,294 ea.—$119,392
Wheel assys.—1213—$231,237
Tanks, collapsible—$96,178
Wheel assemblies, brake assys.—3231—$896,342
Nose wheel assys.—2934 ea.—$112,497
Brake discs—4619 ea.—$194,834
Wheel assys.—100 ea.—$46,267

GREMCO, INC., Fort Worth, Texas
Trailer, cargo—382 ea.—$301,627

HARRIS SUPPLY COMPANY, Chicago, Illinois
Compressor, rotary, gasoline engine driven—454 ea.—$340,500

HILLER HELICOPTERS, Palo Alto, Calif.
Design study of heavy lift helicopter—$70,031

DIESEL ENGINES NEED
md Supercharged Power



MIEHLE-DEXTER SUPER-CHARGERS
INCREASE HORSEPOWER, TORQUE,
ACCELERATE YOUR ENGINES FASTER

Wherever Diesel engines work—buses, tractors, trucks—a Miehle-Dexter Supercharger adds a big boost to performance. Power is increased by the simple addition of this compact, space-saving supercharger. That means *extra* speed at any load, *extra* pushing or pulling power at any speed, wider speed range. More, it means faster acceleration with less smoke. Add all this to engines without increasing size, weight or cost. In fact, weight per horsepower is decreased. Standard M-D models available for most engine applications. For more facts, call or write Miehle-Dexter.

Soon available AN ENTIRELY NEW TYPE OF TURBOCHARGER

MIEHLE md DEXTER
Supercharger Division
Dexter Folder Company
113 Fourth St., Racine, Wisconsin

HOLLEY CARBURETOR CO., Van Dyke, Michigan
Engine spare parts—757 ea.—$54,754
Auto spare parts—14,120 ea.—$41,089

HUGHES AIRCRAFT CO., Culver City, Calif.
Facilities—$715,000
Additional facilities—$752,000
Bracket support assy.; cable assy.; receiver sub-assy.; spare parts—2457—$92,043
Design study of heavy lift helicopter—$54,700
Spare components—$364,006

HUPP CORPORATION, Detroit, Michigan
Facilities for metal parts for Shell, 75MM, T50E2—$113,714

HUPP CORP., Cleveland, Ohio
Semi-trailer, van technical—$56,618
Semi-trailer, van electronics—$51,955
Kit, heater, power plant—$196,547

HYSTER COMPANY, Portland, Oregon
Truck, fork lift, gasoline—64 ea.—$414,414

IHC, Export Co., Chicago, Ill.
Tractors—2 ea.—$45,993

INTERNATIONAL HARVESTER CO., Washington, D. C.
Truck, refuse; truck, tank; truck, chassis, with cab—102—$471,909
Truck, tractor, 5 ton, 4 x 2—168 ea.—$811,381
Trucks—42—$124,490
Light trucks—16 ea.—$31,421
Truck, multi-stop—29 ea.—$86,980
Truck, tractor, 10 ton—801 ea.—$5,443,493
Truck, tractor, 15 ton—78 ea.—$620,480
Truck, multi-stop; truck, pickup; truck, stake and platform; truck, carryall; truck, maintenance—72—$162,916

JACK & HEINTZ, INC., Cleveland, Ohio
Starter—489 ea.—$229,341
Generators, aircraft—$36,941

KAY INDUSTRIES, INC., Detroit, Michigan
Trailer, aircraft engine—693 ea.—$1,361,052

KELSEY-HAYES WHEEL CO., Detroit, Michigan
Machinery and equipment—$2,700,000
Machinery and equipment for J-57 engine components—$2,700,000

KENTUCKY MAUNFACTURING CO., Louisville, Kentucky
Trucks—2 ea.—$18,909
Semitrailer, van—81 ea.—$269,252

LACROSS TRAILER CORP., LaCross, Wisconsin
Semitrailer, lowbed—30—$211,410

LE TOURNEAU & WESTINGHOUSE CO., Peoria, Ill.
Tractor, earthmover type—$27,085

LEECE-NEVILLE Company, Cleveland, Ohio
Alternator assembly—$224,286

LEONARD SPARK PLUG CO., INC., Newark, New Jersey
Motor vehicle parts—150,000 ea.—$89,250

LIBBEY-OWENS-FORD GLASS CO., Toledo, Ohio
Panel-windshield—job—$420,268

LOCKHEED AIRCRAFT SERVICE-OVERSEAS, INC., Burbank, Calif.
T-33A aircraft kits—$4,593,771

LOCKHEED AIRCRAFT CORP., Burbank, Calif.
Implementation program for RF-104-A—$1,000,000

MARMON - HERRINGTON CO., INC., Indianapolis, Ind.
Aircraft fire fighting truck—11 ea.—$473,387

MARQUARDT AIRCRAFT CO., Van Nuys, Calif.
Facilities for RJ-43 engines—$5,000,000
Facilities—$464,000

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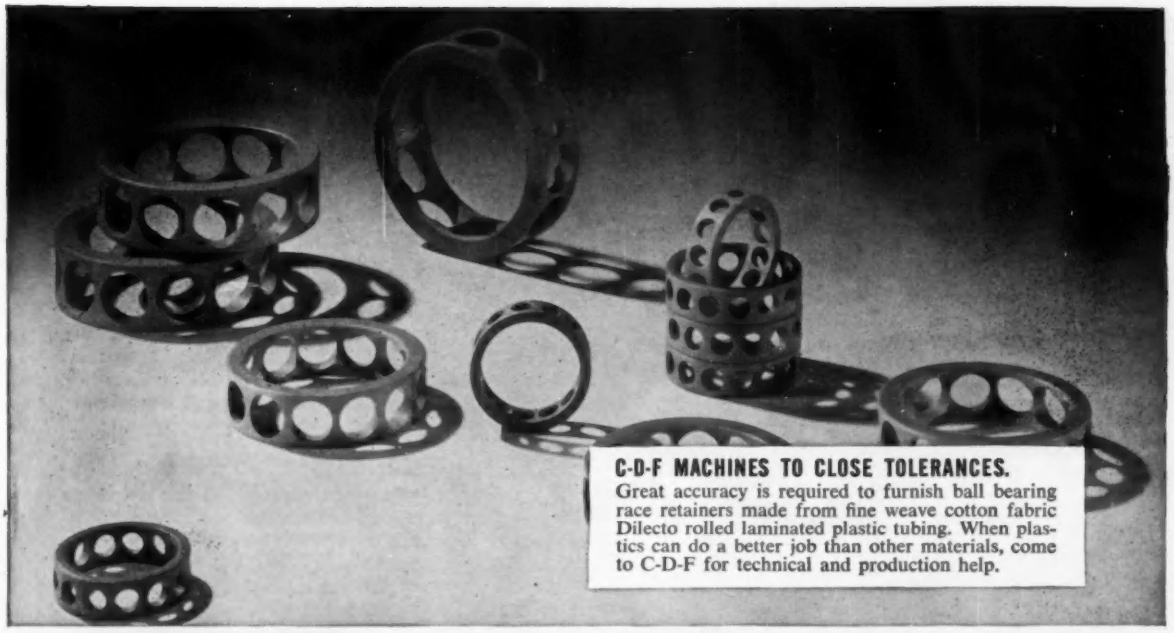
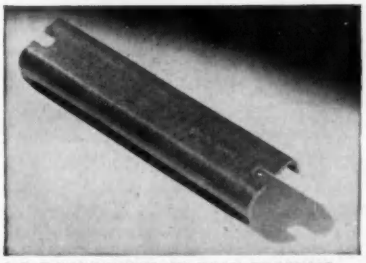
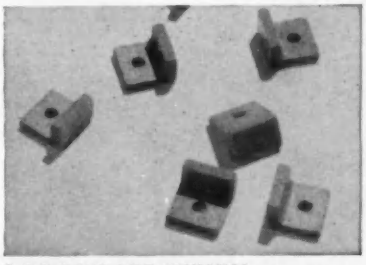


C-D-F MACHINES TO CLOSE TOLERANCES. Great accuracy is required to furnish ball bearing race retainers made from fine weave cotton fabric Dilecto rolled laminated plastic tubing. When plastics can do a better job than other materials, come to C-D-F for technical and production help.



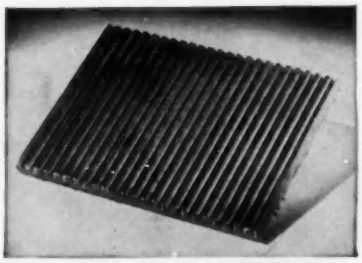
C-D-F PIONEERED IN POST-FORMING of laminated plastics. This technique gives you stronger, more versatile insulating parts with lower costs. This aircraft channel strip is an example of simple post-forming.



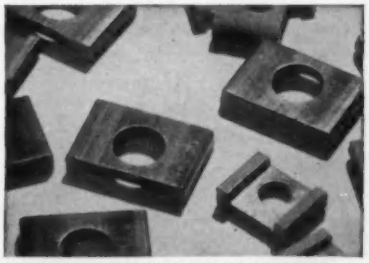
C-D-F DOES THE UNUSUAL. These rubbing blocks are made from fine-weave cotton cloth Dilecto molded *tubing* that has been pierced and cut. The part gains in mechanical strength — the product gets longer service life.

C-D-F SPECIALIZES IN AUTOMATIC SCREW MACHINING of plastic components. These breaker arm bushings are made from Dilecto paper base rolled tubing on high speed machines by men who know and use cost saving methods.

Yes, C-D-F is a big reliable source for fabricated plastics!



C-D-F SERVES MANY INDUSTRIES with fabricated specialties. A great amount is concentrated in the automotive and allied fields. This aircraft part has a corrugated surface on a strong woven asbestos laminated base.



C-D-F IS A PUNCHING SPECIALIST on these starter solenoid insulators. This is XX-26 Dilecto molded channel strip, pierced and punched to length. Special C-D-F punching grades give you lower costs, faster assembly, fewer rejects.

C-D-F COMES UP WITH THE ANSWERS to insulating problems. These unique snap-in grommets are easy to insert, spring out and hold tight. Write for samples. The chances are that C-D-F is already making the answer to your problem.

See our general catalog in Sweet's Design File for more technical data, the address and telephone number of your nearest C-D-F sales engineer. Also, write for detailed information, samples, or send us your print for quotation.

CONTINENTAL DIAMOND FIBRE

CONTINENTAL-DIAMOND FIBRE DIVISION OF THE BUDD COMPANY, INC.

NEWARK 2, DELAWARE

CONTINENTAL AVIATION
CONTINENTAL MODEL 220
SHAFT TURBINE
IN THE AIR—ON THE GROUND
—C.A.E. Turbine Power
Continental, a great name in power, offers advanced development and modern manufacture to those requiring turbine power plants for helicopters, fixed wing aircraft, or ground applications.
CAREERS FOR ENGINEERS
Continental Aviation and Engineering Corporation has numerous openings for personnel interested in challenging careers in gas turbine and reciprocating engine development. For information, address Engineering Personnel Department, 12700 Kercheval Ave., Detroit 15, Mich.
CONTINENTAL AVIATION & ENGINEERING CORPORATION
12700 KERCHEVAL AVENUE, DETROIT 15, MICHIGAN
SUBSIDIARY OF CONTINENTAL MOTORS CORPORATION

(*Continued from page* 144)

THE GLENN L. MARTIN CO., Baltimore, Maryland
Modification of RB-57A airplane—$136,217

MASSEY - HARRIS - FERGUSON, INC., Racine, Wisconsin
Tractor, wheeled, industrial type—397 ea.—$692,431

MELPAR, INC., Falls Church, Virginia
H-37A helicopter trainer—lot—$1,983,981

MEMPHIS COACH COMPANY, INC., Memphis, Tennessee
Automobile, ambulance—42 ea.—$107,064

MINNEAPOLIS - HONEYWELL REGULATOR CO., Minneapolis, Minn.
Facilities—$600,000
MB-1 automatic pilot system—$4,393,473
MA-4 automatic pilot system—$689,808

MONROE AUTO EQUIPMENT CO., Monroe, Michigan
Auto spare parts—24,217—$136,626

MOTOR WHEEL CORP., Lansing, Michigan
Case cartridge for 106 mm rifle—7 ea.—$432,535

MCDONNELL AIRCRAFT CORP., St. Louis, Missouri
Tank assys.—337 ea.—$970,142
Flight test program on F101B—$3,000,000
Parts used on F2H aircraft—various—$61,143

NAPCO INDUSTRIES, INC., Federal Motor Truck Div., Detroit, Mich.
Spare parts—416 ea.—$34,528

THE NEWTON COMPANY, Manchester, Conn.
T-29C and T-29D cockpit procedure trainers—$229,226

NORTH AMERICAN AVIATION, INC., Fresno, Calif.
Maintenance aircraft—18 ea.—$130,000

NORTH AMERICAN AVIATION, INC., Columbus Div., Columbus, Ohio
Ground handling equipment—various—$46,795
Services and material to modernize FJ-3 aircraft—329—$7,485,408

NORTH AMERICAN AVIATION, INC., Los Angeles, Calif.
F-100D aircraft—160 ea.—$21,669,400
Facilities—$35,000
F-100A and F-100D cockpit procedure trainers—$280,622

NORTH AMERICAN AVIATION, INC., Palmdale, Calif.
Additional test facilities F-100 aircraft—$5,000,000

NORTHROP AIRCRAFT, INC., Hawthorne, Calif.
Range finder for gun tank project—$225,000

D. W. ONAN & SONS, Minneapolis, Minn.
Engine generator sets—$202,682

PETTIBONE NEW YORK CORP., Div. Pettibone Mulliken Corp., Rome, New York
Grader, road, motorized—48 ea.—$530,010
Motor graders—2 ea.—$24,892

PIASECKI AIRCRAFT CORP., Philadelphia, Pa.
Repair and/or overhaul of H-21 rotor blade assemblies—120 sets—$71,005

THE PIERCE GOVERNOR CO., INC., Anderson, Indiana
Spare parts for governors—$86,205

PRICE BATTERY CORP., Hamburg, Pennsylvania
Battery, storage—$45,474
Battery—$65,872

RADIOPLANE COMPANY, Van Nuys, Calif.
Aerial target drones and launching equipment—$5,110,702

(*Turn to page* 150, *please*)

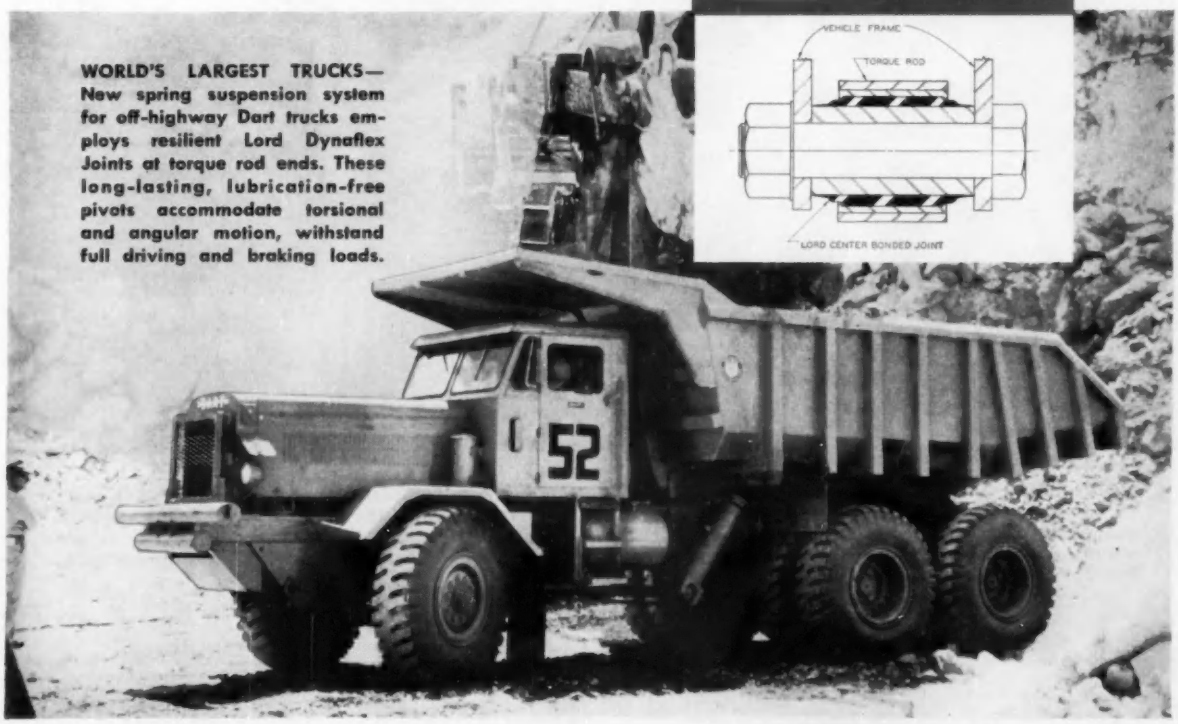
LORD Dynaflex® joints absorb 12-ton driving loads, need no lubrication

LORD Dynaflex Joints, used at torque rod ends on the giant 40 and 55-ton Dart trucks, have load ratings of 12 tons along the rod. They can absorb the brutal beating of off-highway jolts several times the 12-ton driving loads. Yet these super-tough bonded rubber joints last longer than metal units . . . and never need lubrication.

The new high-capacity LORD Dynaflex Joints virtually eliminate pivot point maintenance and operating wear. No metal rubs against metal. The specially compounded flexing element not only absorbs the tremendous driving loads but accommodates angular deflections of ± 2½° and torsional deflections of ± 16°. Simple, compact design requires no close machining tolerances, adapts to present space limitations with little or no change in mating parts.

LORD Dynaflex Joints are economical, can be specially engineered by LORD to your pivot point application—spring eye, load equalizer beam, trunnion, steering axle, radius rod, drawbar connection, boom pivot or others. Take advantage of assembly and maintenance cost savings by using LORD's unsurpassed experience in the design of bonded rubber pivot joints . . . contact your nearest LORD Field Engineer or write the Home Office, Erie, Pennsylvania.

DYNAFLEX JOINT—Twelve bonded rubber joints specially engineered by Lord are used on each Dart truck. Specially compounded flexing element is permanently bonded to inner steel members.



WORLD'S LARGEST TRUCKS—New spring suspension system for off-highway Dart trucks employs resilient Lord Dynaflex Joints at torque rod ends. These long-lasting, lubrication-free pivots accommodate torsional and angular motion, withstand full driving and braking loads.

NEW YORK, N. Y. - Circle 7-3326 • PHILADELPHIA, PA. - LOcust 4-0147
CLEVELAND, OHIO - SUperior 1-3242 • DAYTON, OHIO - Michigan 8871
DETROIT, MICH. - TRinity 4-2060 • CHICAGO, ILL. - Michigan 2-6010
DALLAS, TEXAS - Riverside 3392 • LOS ANGELES, CAL. - HOllywood 4-7593
"In Canada—Railway & Power Engineering Corporation Limited"

LORD MANUFACTURING COMPANY • ERIE, PENNSYLVANIA

LORD BONDED RUBBER

designers and producers of bonded rubber products since 1924

At Scully-Jones and Co., Chicago:

MACHINING COSTS GREATLY REDUCED

Here's how the Carboloy Machinability Computer showed Scully-Jones and Co., Chicago, how to reduce machining time 46% on a single job. Original operating standard for machining expanding shells called for 244 minutes per part. But by calculating the optimum combination of speeds, feeds, and other data on the Computer, the company saved 48.8 minutes per part. The Computer was used to determine setups for both HSS and carbide tools . . . on turning, facing, drilling, and boring operations.

Partial list of plants now using the Carboloy Machinability Computer:

Allied Products Corp.
Armstrong Cork Company
Beech Aircraft Corp.
Bendix Aviation Corporation
Utica Division
Bethlehem Steel Company, Inc.
Boeing Airplane Company
Bryant Chucking Grinder Co.
Burroughs Corporation
Caterpillar Tractor Company
Chrysler Corp.
Airtemp Division
The Cincinnati Shaper Co.
Cone Automatic Machine Co., Inc.
DeLaval Steam Turbine Co.
The DoALL Co.
Fuller Company
General Electric Company
Gisholt Machine Company
Goulds Pumps Inc.
Greenfield Tap and Die Corporation
Geometric Tool Company Division
Greenlee Bros. & Co.
Houdaille Industries, Inc.
Buffalo Hydraulics Division
Jay Manufacturing Company
Claremont Division
Ladish Co.
The Maytag Company
Mergenthaler Linotype Company
Miehle Printing Press & Mfg. Co.
Mueller Brass Co.
The National Acme Company
The New Britain Machine Co.
New Britain-Gridley Machine Division
Pachmayr Corp.
Porter-Cable Machine Company
Reed Roller Bit Co.
Cleco Air Tools Division
The R. K. LeBlond Machine Tool Co.
Rockwell Spring & Axle Co.
Blood Brothers Machine Division
Ryan Aeronautical Company
S. Morgan Smith Co.
Standard Pressed Steel Co.
Sundstrand Aviation
A Division of Sundstrand Machine Tool Co.
Thompson Products, Inc.
Wagner Electric Corporation
Westfield Metal Products Co., Inc.
The Yale & Towne Manufacturing Co.
Yale Materials Handling Division

WITH CARBOLOY MACHINABILITY COMPUTER

- **Determined most efficient cutting conditions**
- **Set up new operating standards in seconds**
- **Eliminated wasteful tryout runs, saved stock**
- **Saved 17 hours' machining time on a single job**
- **Provided closer control over machine downtime**

Obtaining maximum production from their machines is now an easier matter for Scully-Jones and Co., Chicago. Machining data are fed into their Carboloy® Machinability Computer . . . and in seconds, optimum speeds, feeds, horsepower ratings, or any of 16 other operating variables are figured for the operator.

On the job at left, for example, the Computer showed how to cut machining time 46% on a 13-piece run . . . saving 17 machining hours, and eliminating wasteful, time-consuming tryout runs.

Benefits extend plant-wide

On other jobs throughout the plant, the Computer established new operating standards, corrected and verified existing ones. When necessary to improve tool life or production rate, the Computer determined new operating conditions in a fraction of the time previously required.

The advantages of the Carboloy Machinability Computer extend far beyond figuring job setups. The Computer simplified inventory problems by predicting the rate of tool wear. It aided grinding rooms in planning work loads, and helped the plant superintendent coordinate production schedules.

The Carboloy Machinability Computer can be used by anyone with machining experience, after a short familiarization period. And, it can be a powerful educational tool by teaching operators how to improve production or reduce downtime through proper variations in operating conditions.

Ask for demonstration

The Machinability Computer is battery-operated, portable, and rugged. It is priced at $495 (f.o.b. factory, Detroit).

For more information on how the Computer can help your plant increase production and reduce manpower costs, mail the coupon below. If you wish, we will gladly arrange a demonstration in your plant.

CARBOLOY

CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT OF GENERAL ELECTRIC COMPANY

11151 E. 8 Mile Street, Detroit 32, Michigan

☐ Please send more information on the Carboloy Machinability Computer.

☐ Have a representative make an appointment to demonstrate the Computer.

Name_____

Title_____

Company_____

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"Carboloy" is a trademark of General Electric Company

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F.O.S. INDUSTRIAL TAPE DIVISION
THE SEAMLESS RUBBER COMPANY
NEW HAVEN 3, CONNECTICUT

SEAMLESS

(*Continued from page* 146)

REO MOTORS, INC., Washington, D. C.
Bus—1 ea.—$10,562

REO MOTORS, INC., Lansing, Michigan
Trucks, tractors, 25 ton, 8 x 8—2 ea.—$185,500
Brake, shoe, assy.—$38,742
Crankshaft assy.—1469 ea.—$94,148
Wheel, fifth assy.—384 ea.—$67,987

REPUBLIC AVIATION CORP., Farmingdale, L. I., New York
CCN's for F-84 aircraft and repair of damaged aircraft—$385,362
Modification of F/RF-84F mobile training units and additional trainers—$487,566

ROCKWELL SPRING & AXLE CO., Timken-Detroit Axle Div., Detroit, Michigan
Layaway of equipment—$210,000
Spare parts—164 ea.—$184,627

ROGERS BROTHERS CORP., Albion, Pa.
Semitrailer, lowbed, 25 ton—88—$403,212
Spare parts—164 ea.—184,627

ROYAL JET, INC., Alhambra, Calif.
Tank assemblies—10,188 ea.—$2,867,920

RYAN AERONAUTICAL CO., San Diego, Calif.
Hood assys.—365 ea.—$42,519

SCIAKY BROS., INC., Chicago, Illinois
Welding machine resistance, press type—4 ea.—$83,622

SOLAR AIRCRAFT CO., San Diego, Calif.
Propulsion unit—1 ea.—$92,755
Machinery and equipment—$530,000
Gas turbine compressor—$2,456,417
Gas turbine generator set—200 ea.—$2,049,279

SOLAR AIRCRAFT COMPANY, Des Moines, Iowa
Machinery and equipment—$805,000

STANDARD PRESSED STEEL CO., Jenkintown, Pa.
Nut—2,800,000 ea.—$32,480

THE STEEL IMPROVEMENT & FORGE CO., Cleveland, Ohio
Facilities for J-57 engine components—$600,000

STEWART-WARNER CORP., Chicago, Illinois
Shaft, flexible assy.—2448—$10,417
Maintenance kit—8910 ea.—$69,765

STUDEBAKER-PACKARD CORP., South Bend, Indiana
RAD—$345,695

STUDEBAKER-PACKARD CORP., Detroit, Michigan
Machinery and equipment—$1,050,000
Develop manufacturing plan for J-57-P-21—$11,151,164
Design study of shaft turbine aircraft engine—$57,690
Spare parts—1092 ea.—$61,796

SUNDSTRAND MACHINE TOOL CO., Sundstrand Aviation Div., Rockford, Illinois
Parts for PM5-1. 2 A/C—various—$170,223
Transmission and governor assemblies—$1,541,736

SURFACE COMBUSTION CORP., Janitrol Aircraft Automotive Div., Columbus, Ohio
Heater assembly—4 items—$67,737
Body, detachable lead—56 items—$36,020

THE O. A. SUTTON CORP., Wichita, Kansas
Tank, assemblies—10,446 ea.—$2,870,405
Fuel tanks—$412,610

TEMCO AIRCRAFT CORP., Dallas, Texas
Turbo jet powered trainer aircraft—15—$1,978,939

(*Turn to page* 152, *please*)

for heavy radial loads...

or combined radial-thrust loads from either direction—even at extreme high speeds

BCA

ENGINEERS: Send for a copy of BCA's valuable 100-page "Engineering Handbook." Write on your company letterhead. It's free!

single row, deep groove radial bearings

Precision-designed to sustain heavy radial loads or combined radial-thrust loads, these versatile BCA Conrad type ball bearings are built to the highest standards of material and workmanship.

Large size balls give the optimum ratio of ball diameter to bearing race section at the heaviest stressed points. Deep grooved, "high shouldered" raceways permit the bearing to carry heavy thrust loads in either direction equal to 100% of the radial load rating—even at extreme speeds.

When the job calls for *more* than just another bearing, specify the name you can count on . . . BCA. The name is your guarantee.

BCA

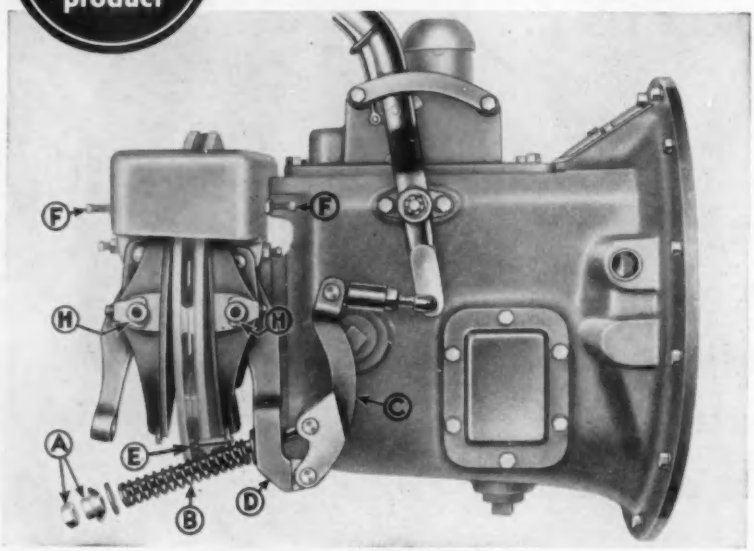
BEARINGS COMPANY OF AMERICA

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC.

LANCASTER • PENNSYLVANIA

an ACCO product

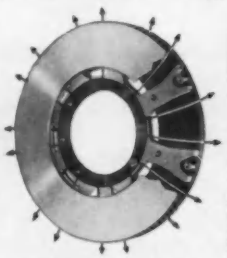
It Pays to Specify TRU-STOP Brakes



How TRU-STOP Brakes save more money than they cost!

TRU-STOP performance in just one emergency may more than offset any additional first cost. But their true economy shows up when it comes time to adjust or reline.

TRU-STOP brakes are adjusted and relined *without dropping the drive shaft.* Both are quickly and easily done with only a few simple tools. Down time is reduced to a minimum.



Longer Lining Life

• The terrific heat generated in braking cuts lining life. TRU-STOPS quickly dissipate this heat. Most of the disc is exposed to the air even during braking. And a cooling jet of air circulates through the disc, prolongs lining life.

See how easily adjustment is made

(illustration above)

1 Tighten nut A so that spring B exerts enough pressure to bring lever C to stop solidly against lever arm D.
2 Insert 1/32" shim between front shoe lining and disc and adjust pull-rod to maintain this clearance, first being sure to have hand-lever in full release position.
3 Further tighten nut A so that rear shoe lining is firm against disc but so that shim in front can still be removed. Remove shim.
4 See that tension spring E is in place, then adjust screws F so that linings are parallel with disc.

See how easily relining is accomplished

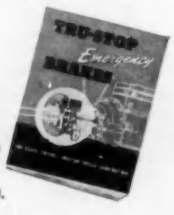
1 Remove nut A.
2 Remove spring E.
3 Apply hand lever so that rear arm can be swung back clear of tie rod and spring.
4 Remove shoe pin locks H, and drop shoe.
5 Replace relined shoes and adjust as per instructions.

ACCO

For full details write for booklet

Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

601 Stephenson Bldg., Detroit 2
2216 South Garfield Ave., Los Angeles 22 • Bridgeport 2, Conn.



(*Continued from page* 150)

THOMPSON PRODUCTS, INC., Cleveland, Ohio
Facilities—$7,286,650

TWIN DISC CLUTCH CO., Racine Wisconsin
Parts for Diesel engines — 5110 ea. — $68,527

UNITED AIRCRAFT CORP., Hamilton Standard Div., Windsor Locks, Conn.
Starters, pneumatic—746 ea.—$1,105,174
Prototype prop assemblies—$2,158,136
Starters, combustion—$1,306,800

UNITED AIRCRAFT CORP., Sikorsky Aircraft Div., Bridgeport, Conn.
Maintenance and test of H-19 and H-34 aircraft—8 ea.—$209,050

UNITED AIRCRAFT CORP., Sikorsky Aircraft Div., Stratford, Conn.
Repair and/or overhaul of H-34 components—90 ea.—$84,584
H-34A cargo helicopters—$10,032,500

UNION CARBIDE AND CARBON CORP., Haynes Stellite Div., Alexandria, Indiana
Machinery and equipment—$200,000

UTILITY TOOL & BODY CO., INC., Clintonville, Wisconsin
Trailer, pole hauling—209—$271,386

U. S. RUBBER COMPANY, New York, N. Y.
Cable assy. and reel — 3164 ea. — $1,267,679

UTICA DROP FORGE & TOOL CO., Utica, New York
Facilities for J-79 engine components—$500,000
Facilities for J-57 engine components—$1,400,000

VICKERS, INC., Detroit, Michigan
Pump and motor assys. — various — $178,684
Services to repair pumps — various — $68,800
Hydraulic pumps—21 ea.—$30,787

WAGNER ELECTRIC CORP., San Francisco, Calif.
Vehicle parts—22,967 ea.—$26,541

WARD LAFRANCE TRUCK CORP., Elmira, New York
Aircraft fire fighting truck—$1,563,790
Fire trucks—2 ea.—$33,642

WESTERN GEAR CORP., Belmont, California
Drive assy.—342 ea.—$242,820

WESTINGHOUSE ELECTRIC CORP., Washington, D. C.
Modification and overhaul of turbo jet engines—39—$496,353

WESTINGHOUSE ELECTRIC CORP., Detroit, Michigan
Tank spare parts—452 ea.—$26,840

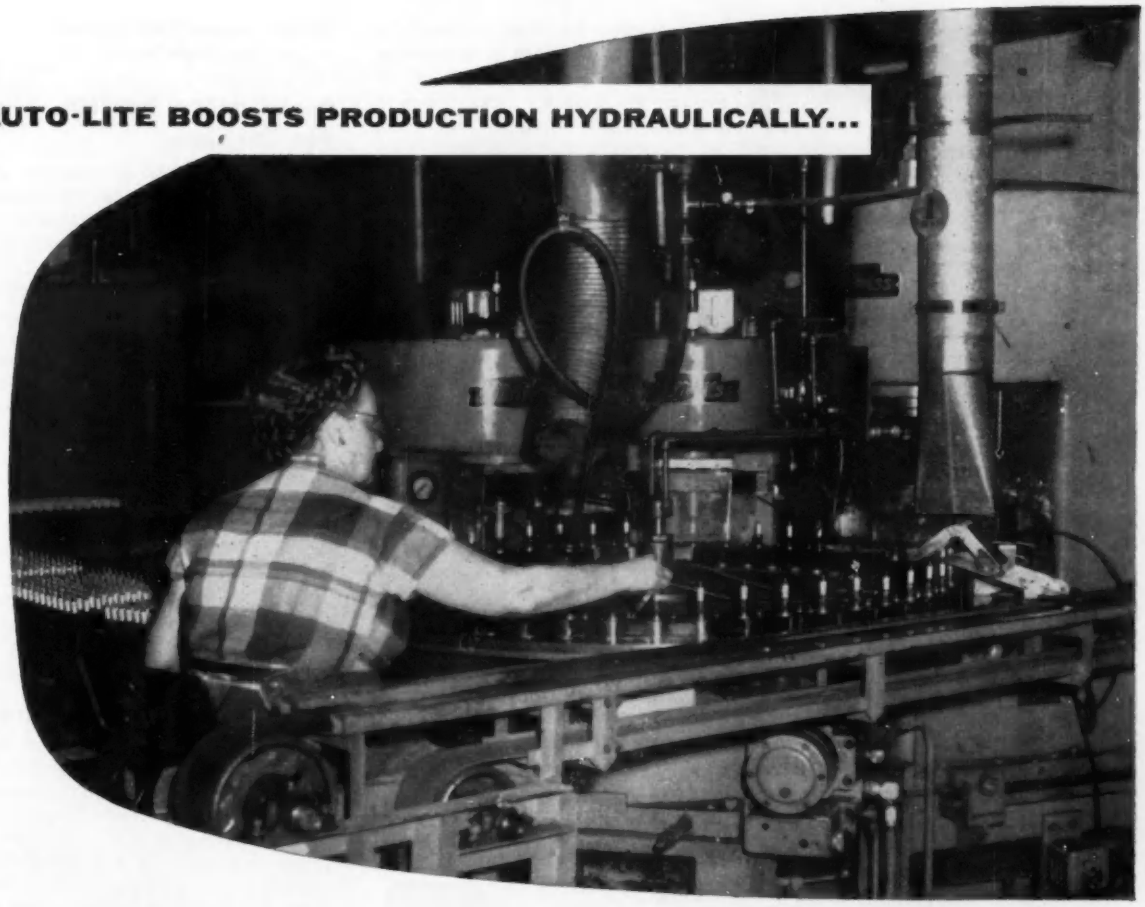
WHITE MOTOR CO., White Diesel Engine Div., New York, N. Y.
Diesel generator—1 ea.—$86,915

WILLYS MOTORS, INC., Toledo, Ohio
Trucks—72—$137,974
Trucks, station wagon—46 ea.—$93,691
Carrier, light weapons, infantry, ½ ton —$2,978,851
Truck, carryall, ½ ton—$112,480

WINPOWER MANUFACTURING CO., Newton, Iowa
Gasoline engine driven portable generators—420 ea.—$53,899

AUTOMOTIVE INDUSTRIES . . .
is your News Magazine of Automotive and Aviation MANUFACTURING

AUTO-LITE BOOSTS PRODUCTION HYDRAULICALLY...



MULTIPRESS® installation automates assembly operations

- ★ **Sets new safety levels**
- ★ **Reduces tool and die costs, eliminates down-time**
- ★ **Improves product quality, provides for future expansion**

The installation of seven 48-station Multipresses at the Fostoria, Ohio, plant of Electric Auto-Lite has introduced added efficiency into a critical production stage — final assembly of spark plugs.

One unit with a single operator (1) pre-presses the top gasket of a spark plug to centralize the insulator within the shell; (2) cold forms the shell to anchor the entire sub-assembly as an integral unit; and (3) seals the shell and insulator. These operations had required *three individually operated presses.*

Since Multipress equipment was installed, materials handling has been reduced and tool and die costs cut substantially. Down-time has been virtually eliminated; maintenance can be carried on without interrupting production. Exact control over force application is now possible, with improved product quality control a direct result.

The experience of Auto-Lite is typical of hundreds of companies who have found that a Denison Multipress, with its automatically controlled hydraulic ram, can produce a better product... faster, more efficiently, and at less cost. Write for complete details.

THE
DENISON ENGINEERING COMPANY
1212 Dublin Road • Columbus 16, Ohio
A Subsidiary of American Brake Shoe Co.

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON Hydr**OIL**ics

AIRBRIEFS

(*Continued from page* 96)

Aircraft manufacturing companies have made constant improvements in organization, utilization of labor and improved production methods to produce more airframe pounds per man-hour than during the War years. Such improvements, and discounting inflation of costs, make the cost of jet fighters and bombers less per pound. Labor costs for airframe workers in 1944 amounted to $1.22 per hour. In 1955 this pay had risen to an average of $2.17 per hour. Using 1947-49 average prices as the index figure of 100, iron and steel costs rose from 65.1 in 1944 to 140.6 in 1955. Nonferrous metals such as copper and aluminum climbed from 60.3 in 1944 to 142.7 in 1955.

In thinking about costs of aircraft it should be noted that a single jet bomber, armed with the latest weapons, has greater destructive capacity than all the bombs dropped by U. S. aircraft in World War I, World War II and Korean War (discounting, of course, the atomic bomb).

Fuel Control System For Turbines

A special control system for gas turbine engines is being made available by Lear, Inc., of Santa Monica, Calif., called the Ultra system. Use is made of temperature sensitive elements to monitor a jet engine's fuel input to maintain turbine speed and temperature in the range of maximum efficiency. Fuel flow is controlled by remote positioning, utilizing electrical connections between the cockpit and the engine. Lear has entered into a 10-year license agreement to manufacture and sell the control equipment in this country. The equipment is an original development by Ultra Electric, Ltd., of London. This system has accumulated more than 10,000 hours of service in Bristol Britannia aircraft flying between London and South Africa.

Lear, Inc., has also just received a $1,692,000 contract for additional automatic flight control systems. The units will be made at the Grand Rapids, Mich., Division and will be installed in America's first jet tanker-transport, the 550-mph Boeing KC-135. Another order for Lear at Grand Rapids amounts to $4,350,000 from the Air Force for their pictorial vertical gyro indicator systems. This instrument permits flying at exact angles of climb, dive and bank as read from scales on the instrument to within an accuracy of one degree.

$40,000,000 Missile Plant

The Atlas intercontinental ballistic missile will be built at a new Montgomery Field plant to be known as Convair-Astronautics, to cost $40 million. The land, buildings and some of the equipment will be borne by Convair Division of General Dynamics Corp. Certain special equipment, including machine tools, will be paid for by the U. S. Air Force.

The new plant will be devoted to research, development, manufacturing and preliminary testing of the Atlas missile and also for related projects looking into the future of astronautics.

The new facility will be on a 252 acre site on Highway 395 near the northeastern San Diego city limits. It is expected that more than 6600 engineering, production and administrative personnel will be employed there by 1958.

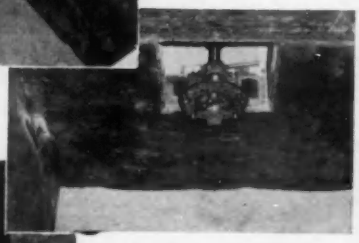
(*Turn to page* 156, *please*)

ROCKFORD

Clutches Are Spin Strength Tested to Meet The Needs of Modern High Speed Engines

First they are put in a deep, armor-plated, concrete test pit.

Then fastened on a shaft that spins the clutch at high speed.



The clutch is spun, and highest R.P.M. recorded.

Let us help insure fully-tested clutches for YOUR products.

ROCKFORD
Clutch Division
BORG-WARNER
315 Catherine St., Rockford, Ill.

CLUTCHES

now, Crucible low nickel stainless steels that meet many of your needs . . .

Here are two *new* Crucible grades, Rezistal type 201 and 202 that are similar in quality and properties to types 301 and 302 . . . but with desirable features all their own.

In the annealed condition, for example, Rezistal 201 and 202 have about 10% higher strength than 301 and 302, yet maintain almost identical ductility. This means that these grades can be fabricated with ease equal to their counterparts. In addition, their mill finishes and corrosion resistance to a wide variation of media compare most favorably with 301 and 302.

To sum up: Rezistal 201 and 202 have practically all the desirable properties of 301 and 302, *plus* some of their own. And they're available *promptly* in all forms. Write now for data sheets fully covering the properties of these new stainless grades. *Crucible Steel Company of America, Dept. AAI, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

AIRBRIEFS

(*Continued from page* 154)

Vibration Control System

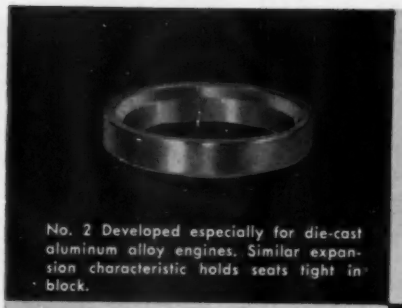
Robinson Aviation, Inc., located at Teterboro Airport, N. J., has just leased 42,000 sq ft of laboratory, factory and office building from the Port of New York Authority. Robinson developed, and is manufacturing, an all metal vibration mount which protects vital equipment from destructive vibration forces. Called the Met-L-Flex mountings, it is made up of a resilient cushion constructed of knitted metal wire, a material somewhat similar to that used by housewives for scrubbing pots and pans.

These vibration mounts have been used widely on jet fighter and bomber aircraft and special ones are being designed for use in the Nautilus and Sea Wolf atomic powered submarines. Latest application is to protect delicate electronic instruments from excessive vibrations experienced in guided missile developments. It is claimed by the manufacturer that as much as two years have been saved on certain military projects where vital guidance equipment has been successfully isolated from the vibration forces.

it's your move!

WAUSAU

HAS THE INSERTS..



No. 2 Developed especially for die-cast aluminum alloy engines. Similar expansion characteristic holds seats tight in block.

No. 7 High chrome content hard seat for heavy duty gasoline engines. Economical, but high in impact and corrosion resistance.

No. 3 Premium quality cobalt tungsten chrome alloy for Diesel and gasoline engines. Dissipates heat, will not crack or loosen, high corrosion resistance, high impact resistance.

No. 1 Molybdenum alloy cast iron seat provides strength at low cost. Easily adaptable to air-cooled engines and tractors.

No. 4 Highest quality bi-metal seat. Standard of quality for almost every heavy duty engine application.

You can "move" in any direction in this line of valve seat inserts . . . choose from special alloyed cast iron, alloyed steel, bronze or bi-metal in flange, throat, threaded or conventional designs. Whichever way you "jump" you land safely with a valve seat proved in service by scores of leading engine builders who have specified Wausau inserts for many years. Metallurgical and design data on request.

WAUSAU MOTOR PARTS CO. • 2200 HARRISON ST. WAUSAU, WIS.

No-Show Control Plan

Effective September 16, 1956, the airlines will effect a new plan to increase the number of seats available in commercial aircraft and protect seats for passengers who intend to use them. Under the No-Show Control Plan, a traveler will not be able to hold a firm reservation unless his tickets are picked up the day before departure. Special ticket pick-up facilities are being planned by the airlines to avoid inconvenience to the public. Use of the plan will prevent or minimize the making of multiple reservations, a practice of making late cancellations, and the practice of passengers who fail to cancel their reservations. It is designed to protect seats for people who intend to use them. A second part of the control plan is expected to entail a penalty charge for a person who picks up his ticket and, without cancelling his reservation, fails to use it. This part of the plan, however, must be approved by the Civil Aeronautics Board before it can be made effective.

Civil Air Patrol Film

The fine work of the Civil Air Patrol in utilizing light aircraft for air evacuation of casualties, aerial photography of disaster areas and aerial supply of stricken cities and other activities will be portrayed in a 15 minute color film. It will be a story of how the civilian volunteers serve their nation and their neighbors during time of disaster and civil defense.

The film will be produced by Producer-Director Henry King and William P. Lear, Chairman of the Board of Lear, Inc., as a public service. Filmed in Hollywood and at Santa Monica Municipal Airport, the C.A.P. film will have its first showing in Washington, D. C., some time during the early fall of 1956. When C.A.P. celebrates its 15th Anniversary in December the film will be ready for nationwide distribution.

Orders for Transport Aircraft

The *Esso Air World*, published by Esso Export Corp., just made a survey of airline orders for civilian aircraft, scheduled for delivery in 1956 to 1959. Scheduled for delivery in 1956 to 1958, 26 airlines will receive long

range, four-engined piston transports as follows: 140 in 1956, 248 in 1957, and 39 in 1958, a total of 427. Medium-ranged piston-engined transports will be delivered to 10 airlines, 55 of them in 1956, and 64 in 1957, a total of 119.

Medium-range propeller turbine transports are scheduled for delivery to 33 airlines; 66 in 1956, 95 in 1957, 56 in 1958 and 13 in 1959. Considering the 100 of such transports already in service (all of them Viscounts), this makes a total of 330.

For the long range propeller turbine transports, 10 companies will receive 14 in 1956, 25 in 1957, 24 in 1958, 98 in 1959, and 28 in 1960, a total of 189.

In the much-publicized long range jet transports, mostly the Boeing 707 and the DC-8, 18 airlines are scheduled to receive deliveries as follows: 12 in 1958, 92 in 1959, 122 in 1960, making a total of 226.

There has been some controversy of late as to whether or not the airlines are providing more available seats than the future air transportation business will utilize. Considering, however, the phenomenal growth of air transportation in the past few years, and the fact that many of the current aircraft will be retired from main line operations, it is believed the airlines are not overoptimistic in their plans for the future.

Western Electronic Show And Convention

The 1956 Wescon Show will be held in the Pan Pacific Auditorium and Annex, Los Angeles, on August 21, 22, 23 and 24. It is estimated that more than 600 exhibits will be on display—the products of more than 600 top electronic manufacturing concerns. This is an all-industry show. The show is sponsored jointly by the Institute of Radio Engineers and the West Coast Electronic Manufacturers Association.

Russian Aircraft

Since General Twining's visit to Russia the names of several Russian aircraft have appeared prominently in print. We thought it would be of interest to define some of these for you. Bison is a four jet, heavy, long-range bomber. It is estimated this bomber has a numerical superiority of almost 2 to 1 over its U. S. rival, the Boeing B-52. Bear is a long-range turboprop bomber capable of intercontinental flight without refueling. It compares with the U. S. Convair B-36. Badger is a medium jet bomber powered by two 18,000-lb thrust engines. This aircraft is similar to the U. S. Strategic Air Command's B-47.

New Liquid Rocket Plant

A $13 million manufacturing plant will be constructed in Sacramento, Calif., under a program recently announced by the Aerojet-General Corp. and the Air Force Air Material Command. The building will provide 360,000 sq ft of space and is expected to require an additional 1000 employes.

Under the joint plan Aerojet General will coordinate its development and production of this work at Sacramento instead of operating the Air Force Production facilities now under construction at Neosho, Mo. Operation of this latter facility has been assigned to the Rocketdyne Division of North American Aviation, Inc. Thus, the Air Force will be assured of two sources of supply for quantity production of large rocket engines.

Helicopter Operations Expand

Scheduled helicopter operations in the United States have steadily in-

another good move...

SPECIFY WAUSAU

HT-100, the "HE-MAN" COMPRESSION RING

— Withstands prolonged engine heat without loss of tension.

— 27% greater impact resistance than ordinary compression rings.

— Very high modulus of elasticity.

— "Ageless." Maintains its excellent stability and physical properties indefinitely.

— Laughs at fatigue, wear and breakage.

For heavy duty commercial vehicles and engines subjected to heavy work loads under difficult operating conditions . . . this is the ring you want. Produced from an exclusive alloy formula HT-100 is a "he-man" of a ring . . . a "brute for punishment" . . . able to function effectively under almost unbelievable conditions. Remarkably tough yet "smooth as silk" HT-100 reduces cylinder wear while at the same time sealing effectively. Write for Technical Bulletin #100.

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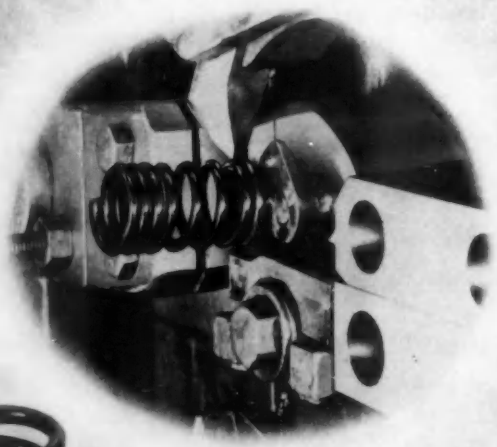
PRECISION?
DEPENDABILITY?
it's Automatic!

QUALITY-CONTROLLED SPRINGS FOR YOUR PRODUCT



Engine Valve Spring as coiled

COILING

at Automatic is another outstanding example of the various precision operations that produce perfect springs for your product. Modern, high speed coilers in a complete range of sizes are arranged for continuous flow production. Every operator is equipped and trained to maintain uniformity and high quality.

During coiling alone, Automatic springs receive these seven quality-control tests.

1. **Tests for proper surface condition**
2. **Tests for diameter**
3. **Tests for free and solid height**
4. **Tests for loads at given heights**
5. **Tests for active and inactive coils**
6. **Tests for pitch or "lead"**
7. **Tests for uniformity.**

FREE!

Valuable booklet on how to specify and order springs. Send for it today

for quality springs "Automatically" think of

AUTOMATIC

SPRING COILING CO.

4048 West Thorndale Ave., Chicago 30, Ill.

creased since the beginning of operations in 1947. In 1947, 37,000,000 revenue plane miles were flown. In 1955, 1,152,000,000 revenue plane miles were flown.

Scheduled passenger operations began in 1953, in which year 26 million revenue passenger miles were flown and 628 million passenger miles in 1955. One thing needed for the expansion of helicopter service is the availability of centrally located and more heliports.

BOOKS . . .

PRECISION ELECTRICAL MEASUREMENTS, *published by Philosophical Library, Inc., 15 East 40th Street, New York 16, N. Y. Price, $12.00.* This collection of 26 papers, which was originally presented at an international symposium held in England, has at its general theme the techniques of precision electrical measurement. Divided into five parts, the papers deal with techniques applicable to electrical fields and dielectrics, magnetic fields and associated materials, electrotechnical measurements, and standard techniques for high voltage measurement and for impulse testing. The papers are unabridged, and summarized discussions appear at the end of each part. The text is profusely illustrated with half-tones and line drawings.

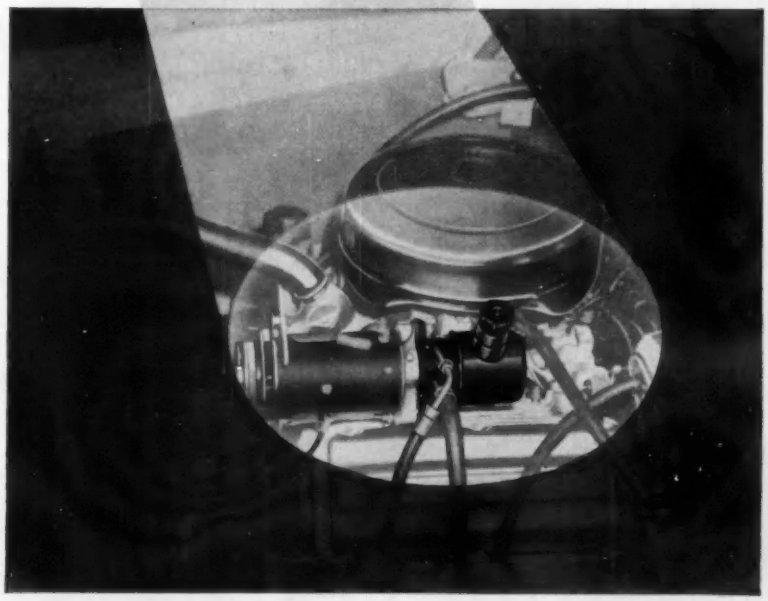
ATOMS AND ENERGY, *by H. S. W. Massey, published by Philosophical Library, Inc., 15 East 40 St., New York 16, N. Y. Price, $4.75.* This book gives a nontechnical account of the developments in atomic physics which led up to the large-scale release of atomic energy. The similarities and differences between the atomic processes which occur in ordinary combustion and in nuclear fission are explained in sufficient detail to give the layman an idea of the immensity of the new power that has become available. The nature and possibilities of the hydrogen bomb are carefully considered. The final chapter describes the efforts of present-day researchers to elucidate the nature of the fundamental particles—electrons, protons, neutrons, pi-, mu- and V-mesons and neutrinos—without any reference to applications.

CHEMISTRY OF CHROMIUM AND ITS COMPOUNDS, *edited by Marvin J. Udy, published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price, $11.00.* This is the first volume of a two-volume monograph on chromium which brings together the latest accurate data on the sources, properties, manufacture and use of metallic chromium, chromium alloys, and chromium chemicals. Volume I, which deals with the chemistry of chromium and its compounds was written by 30 men each of whom has special experience in the particular phase of the subject with which he deals. This volume includes chapters on the history of chromium, its minerology and geology, the physical and chemical properties of its compounds, and on the various industrial uses of chromium chemicals.

CHRYSLER CORPORATION

also Spotlights VICKERS® PUMPS FOR POWER STEERING

Automotive industry recognition of Vickers outstanding achievements in hydraulic pumps for power steering grows continually. The new De Soto and Dodge are among the 1956 automobiles using a Vickers Vane Type Pump for this purpose. The new Model VT24 is extremely compact and light in weight . . . it also has the time-proved Vickers Pump advantages of exceptional dependability, long life, high efficiency and quiet operation.



VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
ADMINISTRATIVE and ENGINEERING CENTER
Department 1428 • Detroit 32, Michigan

MORE VICKERS® VANE TYPE PUMPS than all other makes combined are used for HYDRAULIC POWER STEERING

7391

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

New Defense Facilities

SUPPLEMENTING the list of Certificates of Necessity issued up to June 13, authorizing new or expanded defense plant facilities for the manufacture of automotive and aviation war goods which was published in the July 15 issue, page 166, of AUTOMOTIVE INDUSTRIES, the following additional certificates were announced by the Office of Defense Mobilization, covering the period which extends from June 14 to July 11, inclusive.

The figure appearing in parentheses is the percentage authorized in respect to actual fast tax write-offs.

BENDIX AVIATION CORP., Pioneer-Central Div., Davenport, Iowa
Research and development — $172,800 (40)

BOEING AIRPLANE CO., Seattle, Washington
Military aircraft—$3,272,805 (195)

FAIRCHILD ENGINE AND AIRPLANE CORP., Fairchild Engine Div., Deer Park, L. I., New York
Military aircraft engines—$370,907 (65)

GENERAL ELECTRIC CO., Evendale, Ohio
Supersonic test facility—$19,176,414 (80)

HYDRO-MILL CO., Santa Monica, Calif.
Military aircraft—$224,529 (45)

KAISER ALUMINUM & CHEMICAL CORP., Erie, Pa.
Aluminum forgings—$4,490,663 (75)

LOCKHEED AIRCRAFT CORP., Burbank, Calif.
Military aircraft—$1,177,675 (125)

LOCKHEED AIRCRAFT CORP., Missile Systems Div., Van Nuys, Calif.
Research and development — $385,366 (65)

GEORGE L. NANKERVIS CO., Detroit, Michigan
Military aircraft engines test facilities—$953,471 (50)

NORTHROP AIRCRAFT, INC., Hawthorne, Calif.
Military aircraft—$190,344 (65)

SCIAKY BROS., INC., Chicago, Ill.
Specialized equipment for the military services—$701,681 (50)

STANDARD PRESSED STEEL CO., Jenkintown, Pa.
Titanium fasteners for military aircraft—$2,635,300 (65)

THOMPSON PRODUCTS, INC., Euclid, Ohio
Military aircraft engine parts—$700,000 (60)

UNITED AIRCRAFT CORP., Pratt & Whitney Aircraft Div., East Hartford, Conn.
Military aircraft engines—$1,299,000 (65)

UNIVERSAL-CYCLOPS STEEL CORP., Titusville, Pa.
Military aircraft engine parts—$1,560,650 (130)

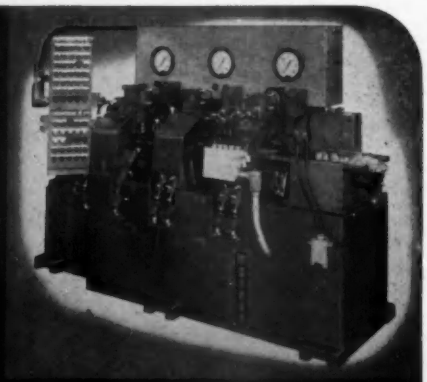
VAHL, INC., Brooklyn, New York
Military aircraft parts—$60,291 (70)

WALDORF INSTRUMENT CORP., Huntington Station, New York
Military aircraft instruments — $686,000 (45)

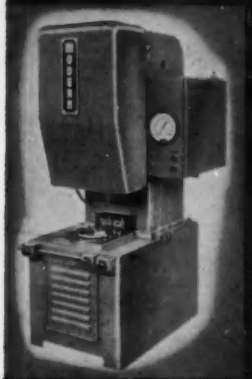
WELLS AIRCRAFT PARTS CO., Santa Monica, Calif.
Military aircraft parts—$103,577 (70)

WESTINGHOUSE ELECTRIC CORP., Baltimore, Maryland
Military electronic equipment—$4,675,000 (45)

Production Pressure Test for AUTOMOTIVE AIRCRAFT APPLIANCE and FARM EQUIPMENT Industries



Transfer unit checks 133 manifolds per hour



Model MPT-1 unit for transmission converter housings

Here are a few features of Modern pressure test units now in service:

- Fully automatic transfer line operation testing three separate manifold passages including marking of O.K. parts. Defectives are automatically color coded to show reason for rejection and shuttled to rework station.
- Semi-automatic checking of transmission converter and end housings including stamping of O.K. parts. Production up to 58 parts per hour.
- Semi-automatic inspection of cylinder heads including automatic "dunking" of defective parts to locate leaks.

Ask for literature describing Modern's pressure test units.

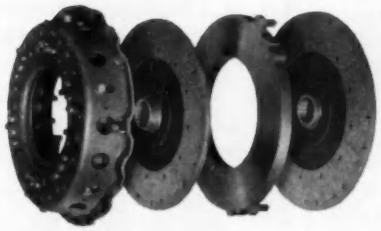
MODERN®
Industrial Engineering Co.
14230 BIRWOOD AVE. DETROIT 38, MICHIGAN

BOOKS . . .

ELECTRICAL INTERFERENCE, *by A. P. Hale, published by Philosophical Library, Inc., 15 East 40 St., New York 16, N. Y. Price, $4.75.* This book deals with the problem of interference with radio and television reception, which normally results from operating electrical machinery, although approximately 10 per cent of interference is caused by inefficient aerial or earth installations at the receiving site. The author treats his subject from a thoroughly practical point of view. He covers the causes and effects of interference; receiver aerial systems; measurement of interference levels; basic filters; safety; and Faraday cages. The book also included a series of photographs of a television screen, showing the effects on the picture of different types of interference.

New equipment, expanded departments, added technical personnel and increased productivity all help to make Long your ideal "production partner."

But you'll discover Long's real plus factors in our management-engineering team. Its talent for creating high quality products with economical design and volume manufacturing advantages is your biggest profit potential.



DOUBLE-PLATE CLUTCHES BOOST TORQUE CAPACITY

Available in many sizes, Long's double-plate clutches with high-gripping action anticipate advancing horsepower and torque requirements in trucks, tractors, off-highway vehicles and industrial applications. Like Long single-plate clutches, these heavy-duty production models are individually tailored by our engineers to performance requirements of any size or type of vehicle.

Long-innovated clutch features that have set industry standards include dry discs, variable springing, high-ventilation triangular covers, spring vibration dampers and cushion segments. Ask us to recommend an application conforming to your specifications.

LONG B-W BORG-WARNER

LONG®

LONG MANUFACTURING DIVISION, BORG-WARNER CORPORATION
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THE STANDARD OF QUALITY AND PERFORMANCE SINCE 1903

Here's a brand-new

"2-in-1"

BUCKEYE ABRASIVE TOOL!

handles like an angle...

runs like a vertical...

for 4", 5", 6" cup wheels
for 5", 7", 9" sanding pads

AND, IT'S QUIET!

Take hold of this newest Buckeye abrasive tool . . . it has the feel and balance, and the ease of handling you expect only in an angle tool. And—it has the gearless efficiency and direct air flow of a vertical tool.

Now, turn it on. That handy twin-trigger throttle gives you pin-point control of the air flow from zero right on up to top speed. Notice how quietly it runs? That's the built-in muffler doing its job. The exhaust deflector, underneath, can be adjusted to any angle you choose.

This NEW Buckeye abrasive tool is available in five speeds, comes complete with dead handle and guard. If you'd like more information, just write—now—for our Catalog A-10. If you'd like to see what this new tool can do on your work, just tell us so and we'll make the necessary arrangements—without obligating you at all.

Buckeye Tools CORPORATION
DIVISION 21 • DAYTON 1, OHIO

producers of the world's first successful rotary air tools

SHORTIES

Automotive plants are located in 25 states; petroleum producers or refiners, in 37; and rubber manufacturers, in 41.

•

About 30,000 hotels, 50,000 motels and tourist courts, and numerous restaurants and tourist homes cater to the highway traveler.

•

The average family car travels about 9400 miles a year. In 1900, the average family would travel a total of no more than 1000 miles.

•

About 41,000 U. S. schools use 123,000 school buses and cars, which travel 4.5 million miles each school day.

•

During World War II, the automotive industries supplied war products valued at close to $29 billion for the armed forces. Included in this total were almost 3.5 million vehicles of all types, 21,835 airplanes; 4288 gliders; and almost six million guns of different varieties.

•

During World War II, the Army alone had 1.6 million wheeled automotive vehicles at peak strength. In addition, tens of thousands of other self-propelled vehicles, such as tanks and other track-laying units, were used.

•

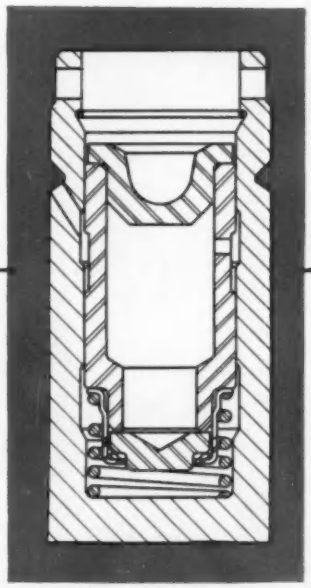
The U. S. with about 6.6 per cent of the world's population has 74 per cent of the world's automobiles and 48.1 per cent of its trucks and buses.

•

A 25-watt bulb could be kept continuously lit for two weeks on the power required to produce one lb of aluminum. The power to make a ton would light the average house for a generation.

•

Gasoline consumption in the United States rose to a record-breaking 51.1 billion gal in 1954.

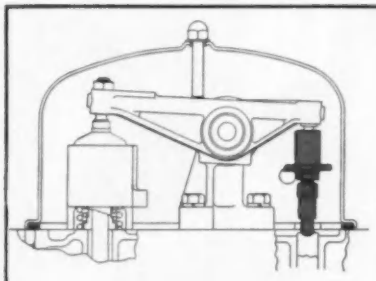


CHICAGO SPRING-LOADED FLAT VALVE HYDRAULIC TAPPET

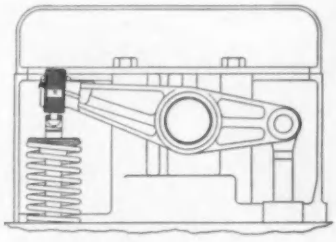
Designing valve gear?

We invite you to use these specialized CHICAGO services

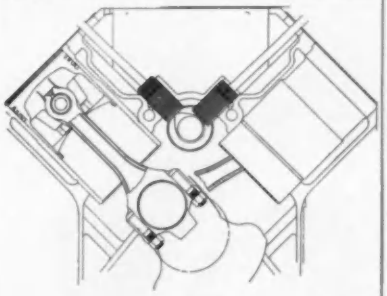
INSERT TYPE ROCKER ARM UNIT



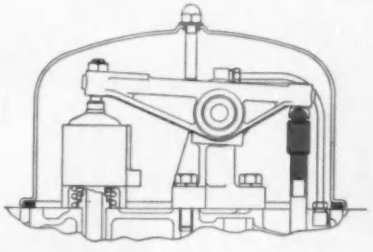
PUSH ROD TYPE FOR COMPRESSION RELEASE APPLICATION



THREADED TYPE ROCKER ARM UNIT



V-8 AUTOMOTIVE HYDRAULIC TAPPET APPLICATION



HYDRAULIC UNIT ON END OF PUSH ROD

Design

of complete valve gear installations for any type of engine . . . passenger car, truck, tractor, diesel, aircraft or industrial.

Development engineering

based on years of specialized experience in valve gear problems. The skills of our engineers will prove a valuable addition to your own engineering staff.

Tappet manufacturing

CHICAGO's facilities insure precision-manufacturing, scientific testing and rugged, trouble-free performance in every tappet. We will welcome the opportunity to serve you.

CHICAGO

THE CHICAGO SCREW COMPANY
Division of Standard Screw Company
2801 Washington Blvd., Bellwood, Ill.
Established 1872

Motor and Control—
standard ratings now
available for immediate delivery
from warehouses coast-to-coast!

TOMORROW:

A Standard Motor That Can Live With Water?

The New Life-Line A Is Another Step Closer

Today's standard motors cannot long endure the water conditions shown here. But Westinghouse is working toward a standard motor that can "live" with water like this tomorrow.

Meanwhile improved frame design, insulation and bearing protection give the Life-Line® "A" more protection than ever before. It can withstand more water and other contamination than any other motor you can buy. It's industry's closest approach to a standard motor that can operate with or within water—in any amount.

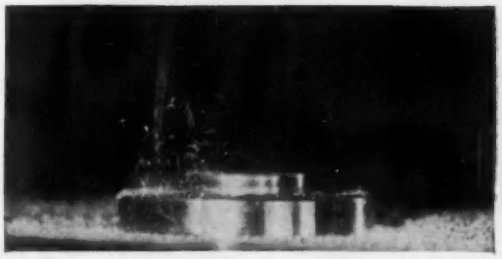
Your Westinghouse sales engineer can show you many additional reasons why the Life-Line "A" is industry's most advanced and preferred motor. Call him today.

J-21924-A

New cast-iron frames and brackets utilize the finest grained castings with uniformly thick-walled sections precisely fitted and sealed—another reason why the Life-Line "A" is so preferred.

WATCH WESTINGHOUSE!

COVER THE PRESIDENTIAL CAMPAIGN ON CBS TV AND RADIO!



Two outer seals of new 4-way sealed bearing act as flingers and literally throw off damaging contaminations. Inner seals, attached to outer bearing race, are stationary and form a positive labyrinth.

ON OUR WASHINGTON WIRE

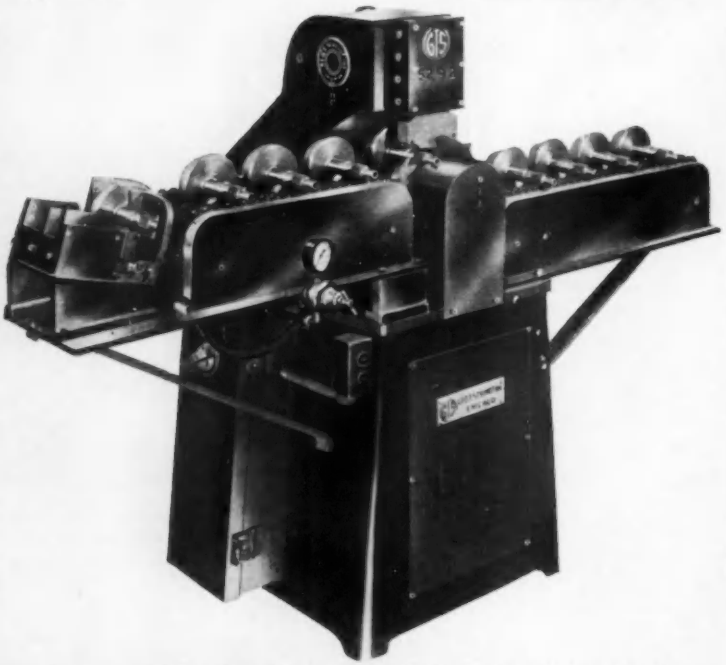
Total defense spending in the next 12 months is fixed at $34,656,727,000 by the Congress. Of this sum the Air Force gets $16,459,125,000 (nearly half): the Navy $9,999,497,000, and the Army $7,539,280,000. Service-wide activities take up the balance.

PINION GEAR MARKING?

GTS Model 395

This fully automatic GTS unit marks code numbers on pinion gears—uniformly and accurately—at a production rate of 900 per minute.

DOES IT *ECONOMICALLY . . . AUTOMATICALLY*



The gears are fed to the spider by means of a chain feed, which carries them under a concave lettering tool. A pneumatic cushion is provided in the die holder to accommodate variations in diameter, insuring uniform depth of marking within both high and low tolerance limits.

FOR FURTHER INFORMATION about this model, or for expert engineering assistance with any industrial marking problem, see your nearest GTS representative, or write direct.

IF IT'S WORTH MAKING, IT'S WORTH MARKING.

GEO. T. SCHMIDT, INC.

4110 Ravenswood Avenue Chicago 13, Illinois

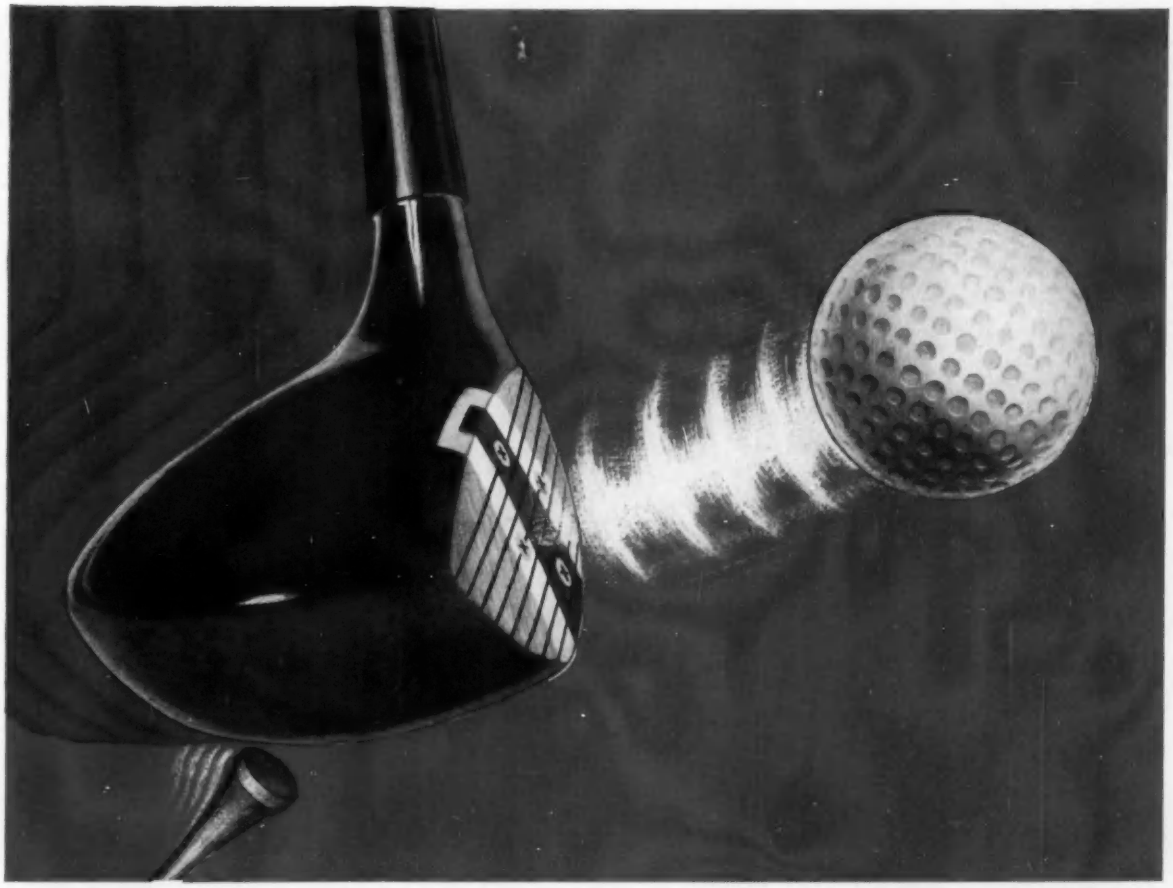
Aircraft manufacturers, on the average, are not making excessive profits, according to a special House Armed Services subcommittee. The group, however, does see some shortcomings in the plane procurement program and policies.

Government has issued three new tax rulings affecting factory sales of automotive products. In separate rulings, the Internal Revenue Service says that manufacturer's excise taxes: do not apply to separate charges made by an automobile manufacturer to its dealers for servicing automobiles delivered by the manufacturer directly to the dealer's customers; must be collected on sales of seat covers made of plastic, terrycloth, corduroy, or similar material; do not apply to rear seat radio speakers.

Although the Congress voted a plump $68.1 billion to run the Government for the 12-month period that started July 1, the Treasury said it would collect even more than this peacetime record sum. Government spending in the fiscal year that closed June 30 hit a total of $66.4 billion.

Obsolescence of Army materials in fiscal 1958 figures to be a greater expense to the taxpayers than the 10 per cent budget increase the Army is aiming for in that year.

Gaining Government agency acceptance gradually are some recommendations made by the second Hoover Commission for more business-like practices of operation. At the latest count, the executive branch of the Government had adopted about 18 per cent of the proposals, while legislative action had accounted for another four per cent. Changes made thus far reportedly will save Federal agencies about $470 million annually.



"Finish first in your league"
...with J&L COLD FINISHED LEADED STEELS

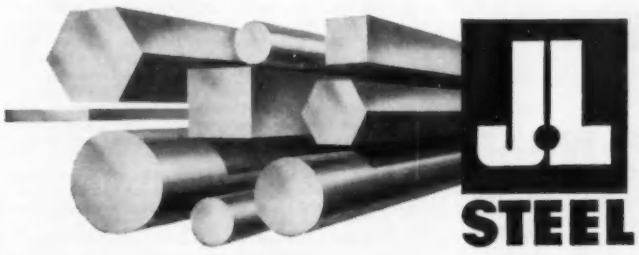
These modern, superior J&L Leaded free-machining cold finished steels are meeting with outstanding acceptance in machine shops everywhere. They are a star member of the complete line of premium quality, free-cutting cold finished bar steels produced over the years by J&L specialists. Thus, we can recommend the right type to help solve your particular machining problems.

Available in *both Bessemer and Open Hearth grades*, J&L Leaded steels offer:

- **SUPERB MACHINABILITY**—because they enable you to use optimum cutting speeds, to secure longer tool life and to produce superior surface finishes.
- **GREATER UNIFORMITY**—because they are completely J&L-produced from the basic raw materials to guarantee optimum uniformity which is so necessary for modern industry's high-speed machining operations.
- **HIGHEST QUALITY**—because they must meet the rigid quality standards developed by J&L through years of leadership in the development and production of free-cutting steels.

Adequate stocks of all J&L cold finished free-machining steels are available in important industrial centers. Phone the nearest J&L District Office or your Distributor for prompt and efficient service.

Pick the Free-Machining Steel that serves you best—from J&L's complete Cold Finished Line



Jones & Laughlin
STEEL CORPORATION · PITTSBURGH

COLD FINISHING PLANTS AT
PITTSBURGH, PA., AND HAMMOND, IND.

NEW

BESLY

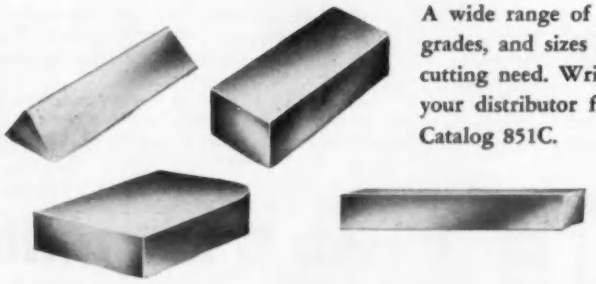
CARBIDE TOOLS

for increased cutting efficiency

BESLY **TOOL HOLDERS and THROWAWAY CARBIDE INSERTS**

A *complete* line of holders and triangular or square throwaway carbide inserts. Write, or ask your distributor for Catalog 852C.

BESLY **CARBIDE BLANKS**



A wide range of styles, grades, and sizes for every cutting need. Write, or ask your distributor for Catalog 851C.

BESLY **BESLY-WELLES CORPORATION**

Est. as Chas. H. Besly & Co., 1875

132 Dearborn Avenue ● South Beloit, Illinois

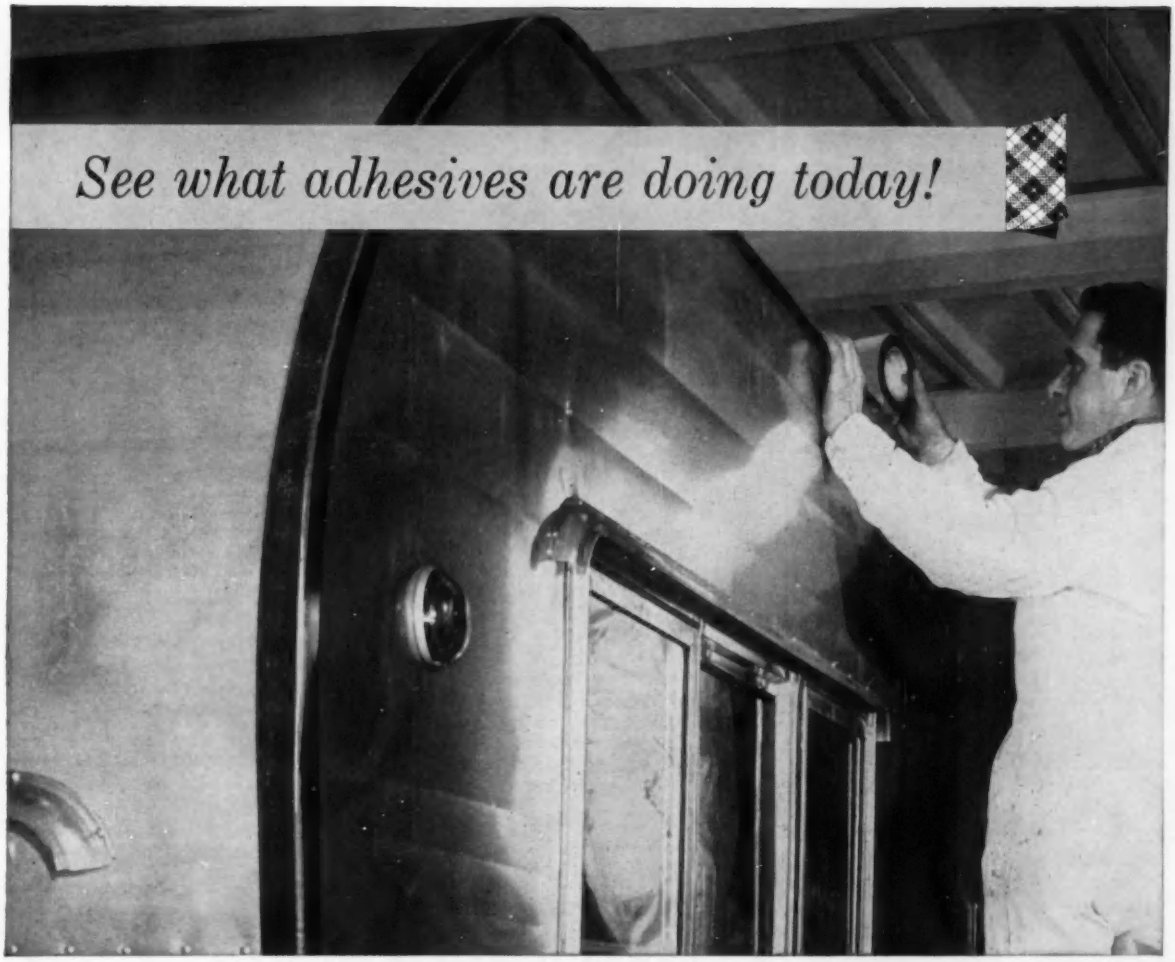
BOOKS . . .

ECONOMICS, (Third Edition), *by Paul A. Samuelson, published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. Price, $4.75.* This book concentrates on important and vital economic problems—inflation and depression; family income and national income; prices, wages and profits; and conditions leading to rapid economic progress and security and to efficient use of all our resources. The author does not attempt to provide recipes or panaceas for the weighty problems as he sees them. His basic aim is to provide an understanding of economic principles and facts from which policy opinions and convictions can be intelligently formed.

TRAFFIC DEPARTMENT ORGANIZATION, *by John H. Frederick, published by Chilton Co., Chestnut and 56th Streets, Philadelphia 39, Pa. Price, $6.00.* Stressing the growing importance of the traffic manager in industry, the author of this book points out that transportation generally is the largest single cost item left in the area of controllable costs today. In order to show how a new concept of traffic management has pared costs and produced savings, the author has used actual case histories taken from such leading firms as Sears, Roebuck; H. J. Heinz; National Distillers; American Chain & Cable; Kaiser Aluminum & Chemical; Maytag; Koppers; Remington Rand and others. Dr. Frederick is a member of the Committee on Education of the Associated Traffic Clubs, and is on the faculty of the University of Maryland.

PANEL DISCUSSION OF PYROMETRIC PRACTICES, *published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $1.50.* This publication attempts to establish precision limits for temperature measurement and control which can be recommended or specified in high-temperature test work. The Panel Session, organized by the Test Methods Panel of the ASTM-ASME Joint Committee on Effect of Temperature on the Properties of Metal, discusses work in this field, and is concerned with ASTM recommended practices on high-temperature testing of metals E 21, E 22, and E 85. Papers included are: Thermocouple Immersion Errors, by J. M. Berry and D. L. Martin, General Electric Research Laboratory; Summary of Pyrometric Procedure Employed by One Company in Creep-Rupture Testing, by W. E. Leyda, Babcock & Wilcox Co.; and Creep and Rupture Test Pyrometry, by Charles R. Wilks, American Brake Shoe Co.

SYMPOSIUM ON METALLIC MATERIALS FOR SERVICE AT TEMPERATURES ABOVE 1600 F, *published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $3.00.* The demand for greater efficiency in heat engines has created a need for metals to withstand operation temperatures above 1600 F. This symposium, sponsored by the General Research Panel of the ASTM-ASME Joint Committee on Effect of Temperature on the Properties of Metal, attempts to provide a basis for evaluating a number of metallic materials, including cermets, which have been undergoing study in laboratories both here and abroad, to determine their suitability for high-temperature service. The papers included in this publication discuss methods of combating surface deterioration caused by high temperatures, as well as the physical, chemical and mechanical properties that are affected by temperature.



Sealing trailers at the seams

When you consider the amount of weathering to which a house trailer is exposed in the course of its service, you can appreciate the importance of effective, all-around sealing.

Finding a seal to keep out dust, weather and noise used to present a real problem. But it doesn't any longer—thanks to 3M's new ribbon-like sealer, EC-1202. Made of synthetic rubber, EC-1202 is extremely flexible and easy to handle. And it's reinforced with sturdy fabric so that it holds its dimensions and is exceptionally easy to apply.

On trailers, like the one pictured above, EC-1202 is used to seal metal corners and edges. Next, an extruded aluminum corner is bolted over it for extra protection, to provide a complete seal against weathering of all sorts.

See what adhesives can do for you . . . You can use EC-1202 wherever metal corners, edges, or faying surfaces need sealing. Your 3M sales engineer will give you all the facts on this and the many other adhesives developed for industry. Call him, or write today for a free informative booklet—to 3M, Department 318, 417 Piquette Avenue, Detroit 2, Michigan.

3M® ADHESIVES

ADHESIVES AND COATINGS DIVISION **MINNESOTA MINING AND MANUFACTURING COMPANY**

417 PIQUETTE AVE., DETROIT 2, MICH. • GENERAL SALES OFFICES: ST. PAUL 6, MINN. • EXPORT: 99 PARK AVE., N.Y. 16, N.Y. • CANADA: P. O. BOX 757, LONDON, ONT.

MAKERS OF "SCOTCH" BRAND PRESSURE-SENSITIVE ADHESIVE TAPES • "SCOTCH" BRAND SOUND-RECORDING TAPE • "SCOTCHLITE" BRAND REFLECTIVE SHEETINGS • "3M" ABRASIVE PAPER AND CLOTH • "3M" ADHESIVES AND COATINGS • "3M" ROOFING GRANULES • "3M" CHEMICALS

TRY THIS TEST
ON YOUR
PRODUCT'S LABEL

Coin test
equals years
of normal wear

Scrape a coin briskly over your product's name plate or decal. Chances are it will scratch the name plate or tear the decal right off. Not so with Metal-Cal.

Even under extreme conditions of temperature and abrasion, Metal-Cals remain bright and easy to read for years. Metal-Cal, the original aluminum foil applique, is made of .003 inch aluminum, backed with an amazing adhesive requiring no screws, pins, rivets or heat for normal application.

And the eye appeal of Metal-Cal's shiny or matte aluminum finish plus a choice of deep, rich colors... anodized, dyed and etched right into the metal, is a real sales tool in itself.

Try the coin test today. See if your present label measures up to the permanent, long wearing beauty of a low cost Metal-Cal.

Metal-Cal®

METAL-CAL Dept. AI
Manufactured by C & H Supply Co.
415 E. Beach Ave., Inglewood 3, Calif.
I am interested in Metal-Cals
Name_____
Company_____
Street_____
City_____ Zone___ State_____
PAT. PENDING

AI TABLOID

(*Continued from page 37*)

Rockwell Manufacturing Co. will erect a $2 million valve manufacturing plant at Kearney, Neb. . . . Minneapolis-Honeywell Regulator Co. will build a new plant near St. Petersburg, Fla., for the manufacture of a new aerial navigation system.

* * *

Kenworth Motor Truck Co. has begun manufacture of a new drop-frame design in all conventional models.

* * *

Temco Aircraft Corp.'s Model 51 will be the Navy's first primary jet trainer.

* * *

Kaiser Aluminum & Chemical Sales, Inc., has expanded its Miami, Fla., and Boston, Mass., branch offices into district sales offices. . . . Baker-Raulang Co. has set up a Chicago factory branch office at 5627 S. Harlem Ave.

General Electric Co. will sponsor a symposium on jet engine overhaul problems at its Evendale, O., plant on Oct. 10, 11 and 12.

* * *

Purolator Products, Inc., has released a new educational slide film on oil filters designed for school and college distribution.

MEN *in the* NEWS

(*Continued from page 41*)

Standard Pressed Steel Co.—Frank G. Kaufman has been made director of plant improvement.

Hill Acme Co.—**A. C. McDaniel, Sr.,** was elected chairman of the board; **J. B. Perkins,** president; **L. L. Hercik,** vice-president and general manager; **H. W. Sullivan,** vice-president; **J. R. Short,** secretary; **A. C. McDaniel, Jr.,** assistant secretary, and **K. F. Bruch, Jr.,** treasurer.

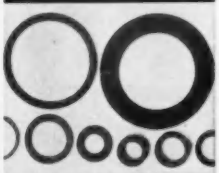
LET GOSHEN RUBBER *help you with* "APPLICATION-ENGINEERED" PRODUCTS *of* NATURAL SYNTHETIC *and* SILICONE RUBBERS

make GOSHEN your HEADQUARTERS for

Products by Goshen Rubber are not stocked, but are precision-fabricated to individual order. They're "application-engineered" to meet strictest specifications as to compound, service life and operating satisfaction. Inquiries regarding any rubber parts problem are invited.

MOLDED PRODUCTS

• LATHE CUT •



BONDED TO METAL

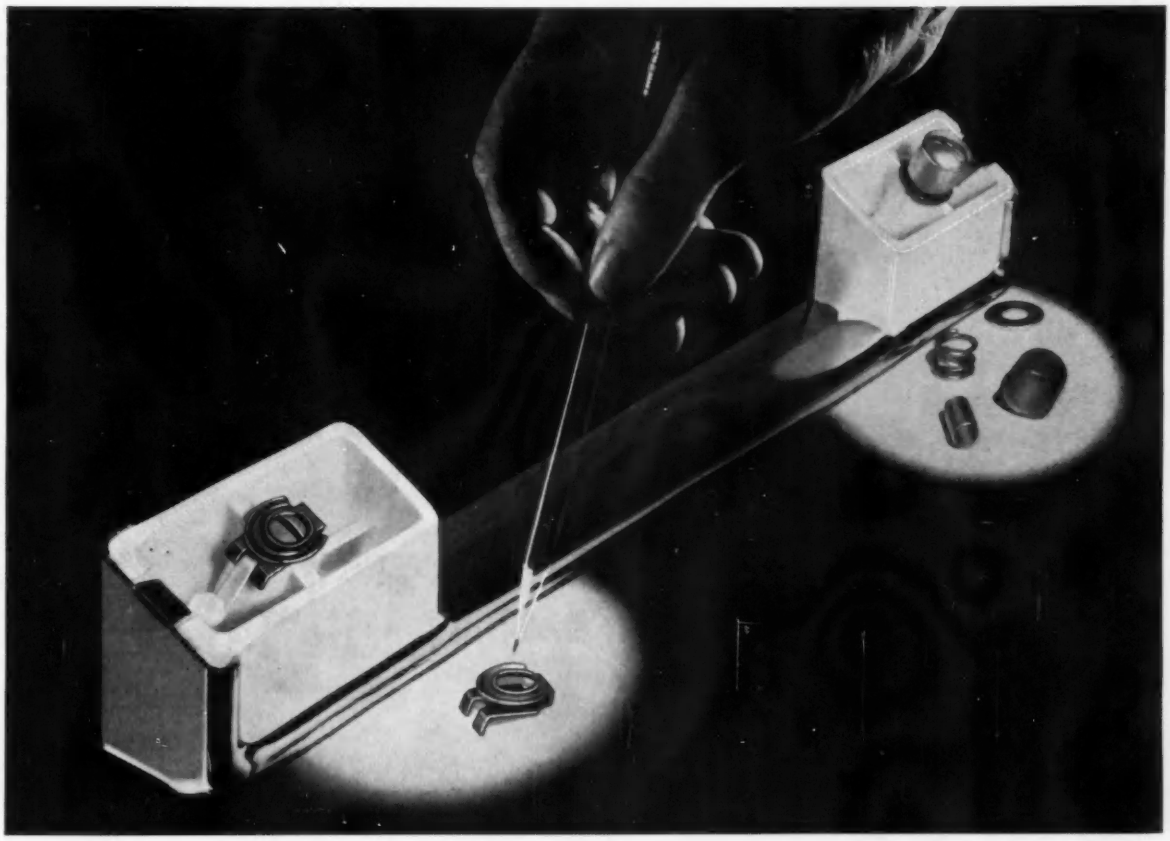
SEND FOR NEW BROCHURE

This 8-page brochure and handy file folder tells how Goshen Rubber can help you. Send for your free copy today.

Over 40th year 1916 · 1956

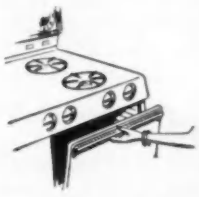
See our "Facilities" catalog in Sweet's Product Design File.

Goshen Rubber Co. INC.
CUSTOM DEVELOPMENT AND FABRICATION SINCE 1916
2786 S. TENTH ST. GOSHEN, IND.



Engineered by Tinnerman...

One-Piece SPEED CLIP® replaces 4-part fastener, helps assembly and shipping... and saves money!



Four separate parts plus screw were required to fasten each end of the removable door handles on kitchen ranges manufactured by the Caloric Appliance Corporation, Topton, Pennsylvania.

Tinnerman fastening specialists teamed up with Caloric designers to eliminate 3 of the parts!

Now . . . a special one-piece, multi-purpose SPEED CLIP plus screw do the same job more efficiently and at lower cost, and reduce small parts handling. Faster, easier assembly . . . fewer parts to buy, inventory and handle. Packed inside the oven for safe shipment with SPEED CLIPS in place, the door handles are dealer-applied in far less time, can be easily removed by the housewife for cleaning.

The resiliency of the spring steel SPEED CLIP prevents crazing or chipping, enables it to absorb varying panel thicknesses and porcelain enamel build-up. Changeover was made without retooling or redesigning door handle or keyhole-shape mounting holes.

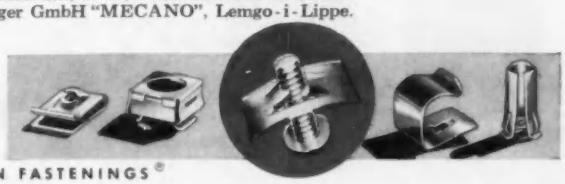
Find out now where SPEED NUT brand fasteners belong on your assembly line. There are more than 8000 variations to choose from. Call your Tinnerman representative for complete details and write for our Fastening Analysis Bulletin No. 336.

TINNERMAN PRODUCTS, INC. • Box 6688, Dept. 12, Cleveland 1, Ohio

Canada: Dominion Fasteners, Limited, Hamilton, Ontario. *Great Britain:* Simmonds Aerocessories, Limited, Treforest, Wales. *France:* Simmonds, S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). *Germany:* Hans Sickinger GmbH "MECANO", Lemgo-i-Lippe.

TINNERMAN *Speed Nuts*®

FASTEST THING IN FASTENINGS®



Whatever your furnace needs for control—

There's good reason why more heat-treating furnaces everywhere are controlled by Brown instruments. First, of course, is performance . . . sensitive, precise control that meets the most exacting requirements of modern heat-treating techniques. And equally important is versatility. In this varied line of instrumentation you'll find just about everything a furnace could possibly need in the way of control.

Choose *ElectroniK* Strip Chart Controllers for detailed, long-term records . . . and a selection of control forms including electric systems of the contact, position-proportioning (*Electr-O-Line*) and time-proportioning (*Electr-O-Pulse*) types; and pneumatic control from two-position to full proportional-plus-reset-plus-rate action.

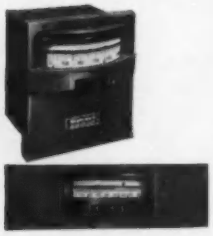
Choose *ElectroniK* Circular Chart Controllers for ease of scale reading . . . convenient daily charts; in a full range of electric and pneumatic control forms.

Note: the basic components of all *ElectroniK* models are interchangeable . . . to simplify and speed up service.

Choose *ElectroniK* Circular Scale Controllers where you want readability and control check at extreme distance . . . without need for a record. Supplied with all contact and proportional types of electric control.

Note: all *ElectroniK* models are available in both Standard and Precision Series.

Choose *Pyr-O-Vane* Controllers where you don't need a record but do need precise vane type snap action electric control by a millivoltmeter instrument... alsoavailable with pulse-type time proportioning action, in both vertical and horizontal models.



Choose the *Protect-O-Vane* Safety Cut-Off for simple, dependable excess temperature protection ... can be used with any temperature control to prevent furnace shut downs and loss of production.

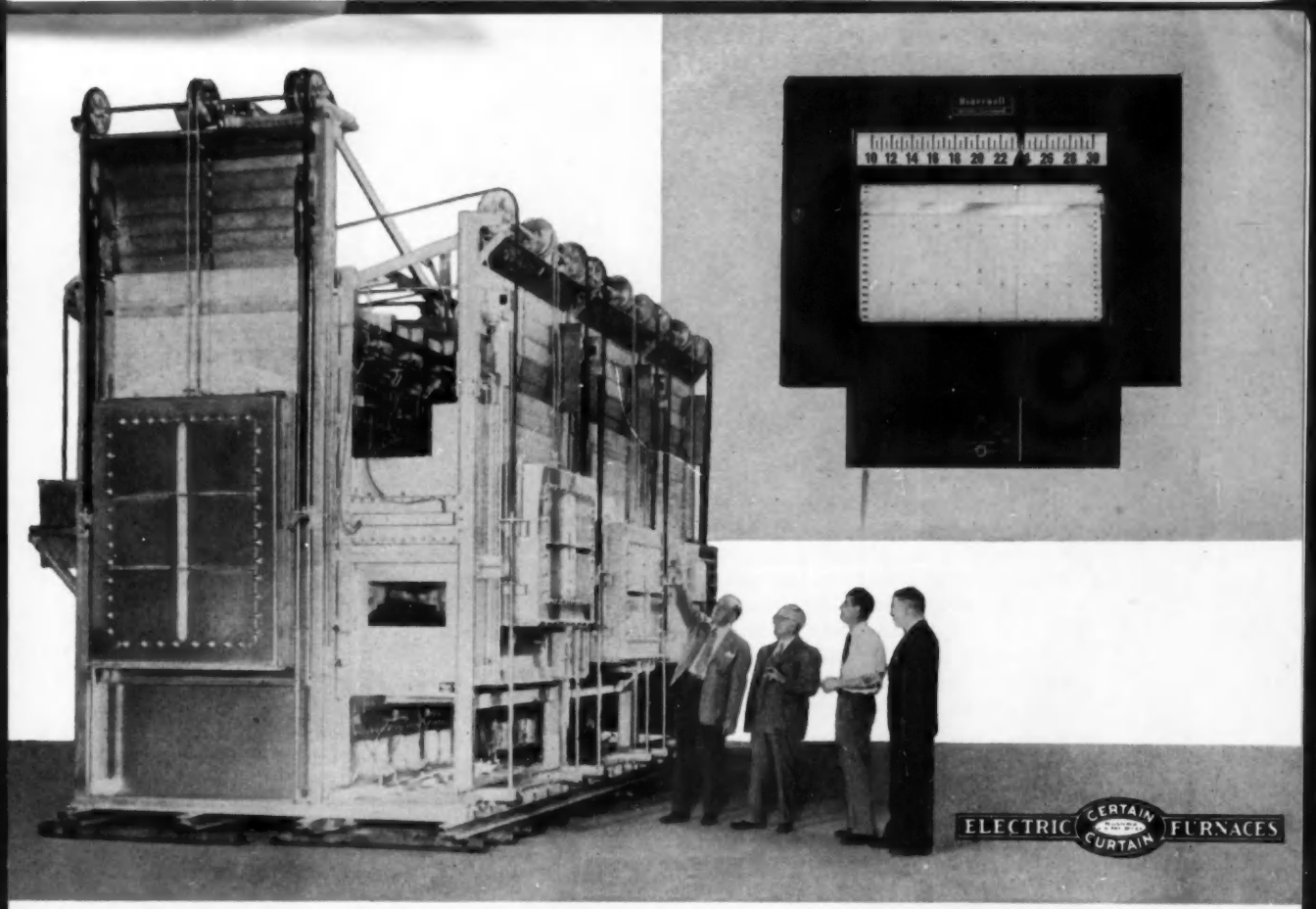
• • •

And for all your pyrometer supplies, investigate the convenience and economy advantages of the HSM Plan.

Product of the engineering skill of C. I. Hayes, Inc., of Cranston, R. I., this giant furnace has a heating chamber 19' long, 8' 2" high and 4' wide.

World's largest electric steel forging furnace

Listed in Catalog 1531 are the varied types of **ElectroniK** *Controllers . . . including electric and pneumatic systems affording a broad selection of control action. Write for your copy.*



uses *ElectroniK* instruments

SPECIALLY DESIGNED and constructed by C. I. Hayes, Inc., this mammoth furnace will heat up to 10,000 lb. billets for forging in a 50,000-ton press at Wyman-Gordon Co.

Forty-five Globar elements, with a total connected load of 600 kilowatts, supply the heat input for an operating temperature of 2400°F. under a controlled atmosphere.

Accurate, dependable instrumentation is required . . . to keep the heating cycle as short as possible, for power economy . . . to avoid temperature override, for protection of furnace and work. Sixteen *ElectroniK* proportional controllers were selected to handle this responsibility, and will help Wyman-Gordon Co. set production records with the largest "Certain Curtain" furnace ever built.

Through continuing cooperation with furnace manufacturers and users, Honeywell is applying the *ElectroniK* principle to countless control problems. The improvements in operating efficiency, product quality, production rate, and savings in materials and labor have earned an enviable reputation for *ElectroniK* controllers.

These instruments, and others in the complete Honeywell line, are highlighted on the opposite page. To help select the type that suits your specific needs, call in your local Honeywell sales engineer for a detailed discussion . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Lepel
HIGH FREQUENCY *Induction* HEATING UNITS

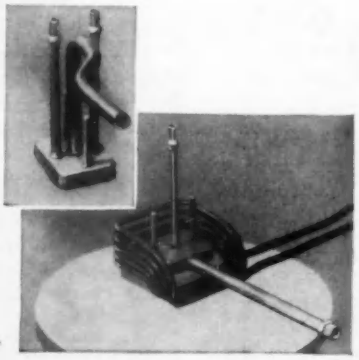
BRAZING
HARDENING
BOMBARDING
SOLDERING
ANNEALING
MELTING

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.

TYPICAL INDUCTION HEATING APPLICATIONS

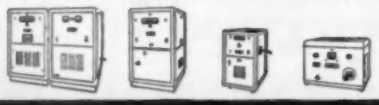
A Lepel installation at Federal Telephone and Radio Co. shown soldering transformer terminals. A precision operation made so simple that even unskilled operators can achieve excellent results on a production basis.



The simultaneous soldering of a group of components within one load coil is an ideal application for induction heating. The assemblies consist of mounting studs and tubes inserted into a machined part together with preformed solder rings. The heating is done so rapidly that there is practically no scaling or discoloration.

Electronic Tube Generators—1 KW; 2½KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.
Spark Gap Converters 2 KW; 4 KW; 7½ KW; 15 KW; 30 KW.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.



All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

Unanswered Questions

(*Continued from page* 104)

The Role of Daimler-Benz

ONE of the most interesting and rather surprising elements in the entire Curtiss-Wright arrangement with Studebaker-Packard is the entry of Daimler-Benz A. G. of Germany into the picture. Presumably, Curtiss-Wright is deeply interested in the foreign firm's work in the Diesel and gasoline engine fields and is of the opinion that such German developments would admirably complement Studebaker-Packard automotive activities. Whether such a relationship would be further extended to the assembly and/or distribution of Mercedes-Benz vehicles in the U. S. remains open to question. It is not beyond the realm of possibility, however, that such a tie-up might be effected eventually.

The deal with Daimler-Benz further provides that it will obtain rights to produce certain Curtiss-Wright products in Germany. No indications were given as to just what these products might be, but Curtiss-Wright aircraft engines loom as distinct possibilities. This again, however, is entirely a matter of guesswork, and only time will tell the tale. The same may be said of the other questions raised above, to which only the future will provide the answers.

Chromalloy Process

The August 1 issue of AUTOMOTIVE INDUSTRIES carried on page 68 an article describing a new process which reduces costs and conserves critical materials in a number of aircraft applications. The patented process, known as Chromallizing, is controlled by Chromalloy Corp., 450 Tarrytown Road, White Plains, N. Y.

Classified Advertisements

Due to the relaxation of exchange (of money), a leading and reputable French manufacturer of shock absorbers for automobiles would be interested in the sale or manufacture in France under license of high-quality telescopic shock absorbers. Address propositions to: l' Agence HAVAS, No. 402/598 Rue Vivienne 17, Paris, France.

150 H.P. TYPE TLC-50 G.E. DYNAMOMETER 2200-4000 R.P.M. COMPLETE WITH SCALES, CONTROL PANEL, GRIDS, TACH AND CONVERTER. CAN BE SEEN IN OPERATION 8:30 to 5:00. EXCELLENT CONDITION. REASONABLY PRICED. HOOF PRODUCTS COMPANY, 6543 S. LARAMIE, CHICAGO 38, ILLINOIS. PORTSMOUTH 7-6330.

these bottles are the key...
THEY WON'T BREAK
Plastic electrolyte containers have great resistance to impact.
THEY'RE LIGHTWEIGHT, COST LESS TO SHIP
15 plastic bottles weigh less than one glass bottle . . . save up to 30% on shipping charges.
THEY'RE SAFE AND EASY TO HANDLE
Handling sleeve in each carton lessens chance for spillage.
THEY'RE DISPOSABLE
Rinse out and destroy. No storing, re-filling or returning bottles . . . no cash tied up in carboys or empties.

to extra values you get with **GLOBE'S** dry-charged battery program

And here's why you can do a better merchandising job with today's finest dry-charged battery

DEVELOPED and backed by Globe-Union — a name that has meant top-flight batteries and battery merchandising for nearly forty years — this recently introduced program has but one aim. And that's to make *your* battery selling easier, more profitable . . . a better buy for both you and your customers.

With dry-charged batteries, you eliminate trickle charge, standing loss . . . assure your customers of factory-fresh starting power. But when you "go with Globe," you get a host of additional values. You deal with a single, compact carton — a carton that contains battery, electrolyte and pouring sleeve. It's easier to stock and handle. And traffic-stopping design promotes striking, buy-compelling displays.

But the Globe extra value story doesn't end here.

FAST DELIVERY WHEREVER YOU'RE LOCATED

The 13 strategically located Globe dry-charge battery production plants, starred at right, assure quick and inexpensive delivery on dry-charged battery shipments.

COMPACT, EASY TO STORE AND HANDLE, ALL-IN-ONE CARTON contains battery, pre-measured, top quality electrolyte . . . safety-insuring pouring sleeve with printed instructions for activation.

GLOBE-UNION INC.

MILWAUKEE 1, WISCONSIN

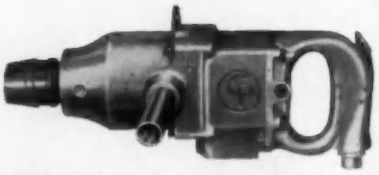
If it's petroleum-powered, there's a Globe-built battery — right from the start!

*ATLANTA, GA., *DALLAS, TEXAS, *EMPORIA, KANSAS, *HOUSTON, TEXAS, *LOUISVILLE, KY., *MEDFORD, MASS., *MEMPHIS, TENN., *MILWAUKEE, WIS., *MINERAL RIDGE, OHIO, *PHILADELPHIA, PA., *REIDSVILLE, N. CAROLINA, *SAN JOSE, CALIF., *HASTNGS-ON-HUDSON, N. Y., LOS ANGELES, CALIF., OREGON CITY, ORE., AJAX (ONTARIO) CANADA

SAVE TIME "ON THE LINE"

with

CP Air and Electric Impact Wrenches



CP-610-RP Reversible Air Impact Wrench with pistol grip.

CP-3440-RS Reversible Air Impact Wrench with ½" sq. drive shank.

CP-903R Kit-Packed Electric Impact Wrench with ½" square drive.

2000 blows per minute give the CP-903-R Universal Electric Impact Wrench fast, powerful impact action. Nose section measures only 2" in diameter . . . affords easy access to tight, hard-to-get-at spots. Has rated ⅜" bolt size capacity but handles many ⅝" applications. Available with carrying case containing six hex sockets and drill and tap chuck.

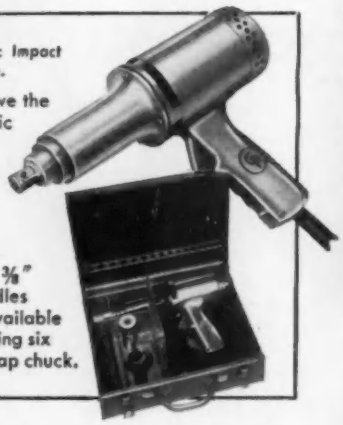
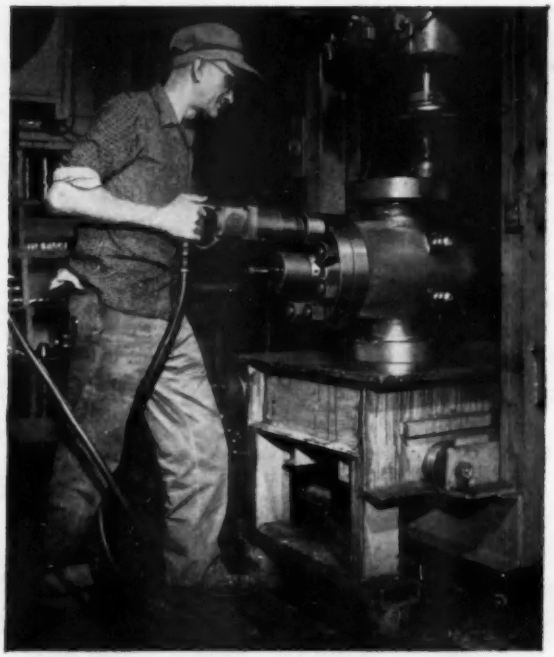


TABLE OF CAPACITIES

Wrench Number	Bolt Size
AIR	
CP-337	¼"
CP-334	⅜"
CP-3440	⅜" heavy-duty
CP-349	⅜"
CP-3490	⅜" heavy-duty
CP-360	½"
CP-3630	½" heavy-duty
CP-610	1¼"
CP-375	1¾"
ELECTRIC	
CP-903-R	⅜" - ⅝"



Check the fast-moving, smooth-running production lines in industry and you'll find Chicago Pneumatic reversible Air Impact Wrenches at work, stepping up output, stepping down costs. You'll find Air Tools like the CP-610 saving 25% to 75% of nut running and removal time. You'll find angle head models in all sizes, adding ease to jobs that are normally awkward and hard-to-reach. Other CP Air Wrenches available in capacities from ¼" bolt size to 1¾". Pistol, spade or side handle models are available.

Chicago Pneumatic

8 East 44th Street, New York 17, N. Y.

Pneumatic Tools • Air Compressors • Electric Tools • Diesel Engines
Rock Drills • Hydraulic Tools • Vacuum Pumps • Aviation Accessories

Caterpillar Tractor Co. speeds up parts handling with USS GERRARD STEEL STRAPPING

The use of Gerrard Round Steel Strapping has enabled Caterpillar Tractor Co. to turn out tighter, safer pallets and cartons of materials in far less time than was previously required. Caterpillar uses Gerrard Round Strapping for all types of reinforcing applications, from cartons of small parts to huge pallets of engine blocks.

Available in a wide range of sizes, USS Gerrard Strapping, Round or Flat, is virtually tailored to every tying application, regardless of the shape or size of the pallet or crate.

Initially, the cost of Gerrard Round Steel Strapping is low—about *40% less* than any other form of metal reinforcement. Moreover, it cuts materials handling time to fractions, and produces firmer, safer-to-handle, easier-to-stack packages. Gerrard Strapping is quick and easy to use, and once bundles are strapped, they need no further inventorying. Pilferage is eliminated and damage is reduced to a minimum.

If you have a packaging-tying problem, why not give our engineers a crack at it? They could come up with just the right solution to benefit you *and* your customers.

NEW CATALOG—HOT OFF THE PRESS!

36 pages of photographs, description, facts and figures on all USS GERRARD Steel Strapping and associated equipment.

GERRARD STEEL STRAPPING DIVISION, UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CHICAGO, ILLINOIS

USS GERRARD STEEL STRAPPING

Round and Flat

UNITED STATES STEEL

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Gerrard Steel Strapping
4725 South Richmond St., Chicago 32, Ill.

Please send me, free of charge, the new 36-page GERRARD Blue Book of Packaging.

Name .....

Company .....

Address .....

City ..... State.....

The drafting stage—not later—is the time to design-in oil seals!

Oil seals are precision products. They are designed to operate under a specific set of conditions. Change just one of those conditions—lubricant, shaft speed, temperature, even bearing position—and a different seal will almost always be needed.

Why chance costly retooling or remanufacture? Specify the correct seal on the drawing-board. And when you do, get all the information there is on new seals, new lip compounds, and mechanical designs. Get it from your National Oil Seal Engineer. His counsel is complete, up-to-the-minute, and accurate. You couldn't buy better oil seal information, yet his help is yours for the asking.

Why "do it yourself?" Call the nearest National Oil Seal Engineer now.

NATIONAL MOTOR BEARING CO., INC.

Plants at Van Wert, Ohio, Redwood City, Downey and Long Beach, California

General Offices at Redwood City

CHICAGO, ILL. . *Room 462, McCormick Building, HArrison 7-5163*
CLEVELAND, OHIO . *210 Heights Rockefeller Bldg., YEllowstone 2-2720*
DALLAS, TEXAS . . . *2520 West Mockingbird Lane, DIxon 7541*
DETROIT, MICH. . . . . *13836 Puritan Avenue, VErmont 6-1909*
DOWNEY (Los Angeles Co.), CALIF. . *11634 Patton Rd., TOpaz 2-8163*
INDIANAPOLIS, INDIANA . . *2802 North Delaware St., WAlnut 3-1535*
KANSAS CITY, MISSOURI . . . . . *4445 Terrace, LOgan 6622*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
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REDWOOD CITY, CALIF. . . *Broadway and National, EMerson 6-3861*
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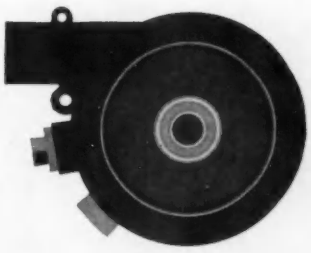
3880

DO YOU USE FABRICATED METAL PARTS? .. VOLUME GOING UP?



.. this chart shows how Richardson molded parts can reduce production costs (example: a water pump housing):

Year	Production Method	Total Annual Quantity	Total Cost	Unit Cost
1st year	fabricated metal	3,600 pump housings	labor and material $7,200.00	$2.00
2nd year	molded plastics	now increased to 12,000 pump housings	plastic mold ..... $8,000.00 12,000 housings purchased from Richardson 9,000.00 $17,000.00	$1.42
3rd year	molded plastics	same quantity—12,000 pump housings	mold (charged off on previous year's production—still good for hundreds-of-thousands of parts) ..... — 12,000 housings purchased from Richardson $9,000.00 $9,000.00	only 75c

Molded parts also offer these advantages:

.. smooth, attractive surface!

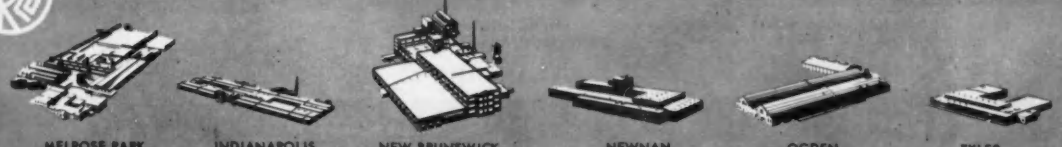
.. no painting necessary—plastic is rustproof!

.. save assembly time—inserts mold in!

.. plastic reduces noise and insulates against heat!

Richardson engineers are available to assist you in determining molding costs. Working with your own engineers, they can cooperate in the development of new designs for improved performance, better appearance, and reduced production costs .. experienced tool and diemakers, working in one of industry's largest tool and die shops, can produce long-lasting molds accurately. Write or phone today—Chicago, MAnsfield 6-8900. The Richardson Company, 2678 Lake St., Melrose Park, Illinois (Chicago area).

RICHARDSON PLASTICS **MOLDED AND LAMINATED**



MELROSE PARK, ILL. · INDIANAPOLIS, IND. · NEW BRUNSWICK, N. J. · NEWNAN, GA. · OGDEN, UTAH · TYLER, TEXAS

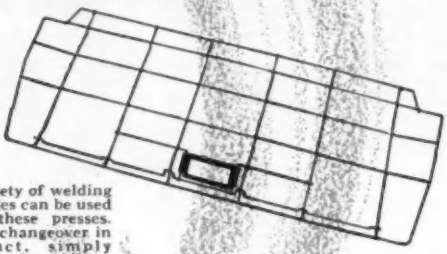
FEDERAL WELDING PRESS . . .

a complete seat frame with every press stroke!

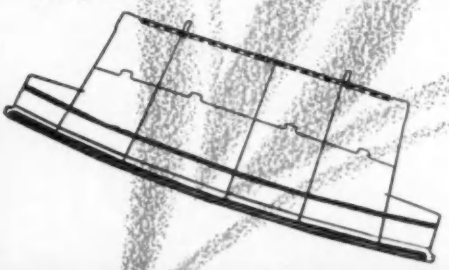
Frames for automobile seat backs and cushions are being resistance welded on Federal Welding Presses at the Great Lakes Spring Division of Rockwell Spring and Axle Co.

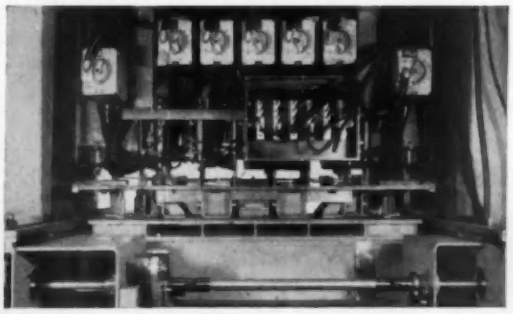
Only Federal can offer single company responsibility in supplying both the mechanical welding press and the welder tooling based on their long experience in both press (Warco) and resistance welder (Federal) manufacture.

There are many manufacturing operations existing today where a mechanical welding press would pay dividends. If you have one of them, why not contact the one company best suited to provide the answer? That's *Federal — First in Resistance Welding.* Welding Press brochure on request.

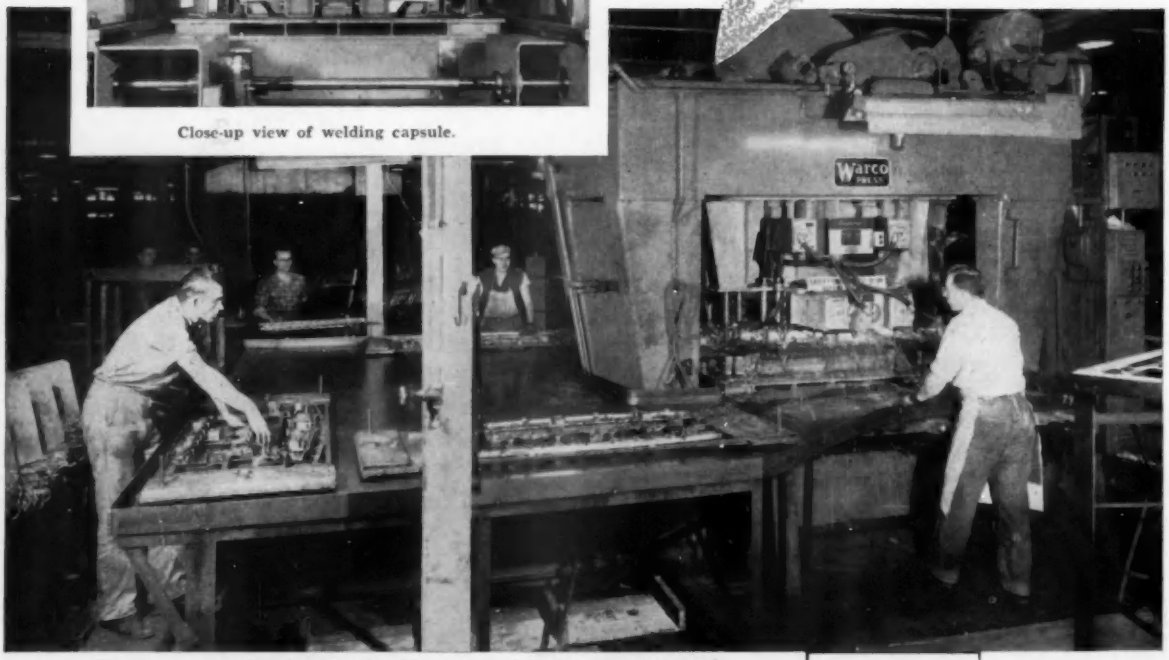


A variety of welding capsules can be used with these presses. For a changeover in product, simply change the tooling.





Close-up view of welding capsule.



There's no comparison between the old single weld method and this "automated" production line made possible through the Federal Welding Press.

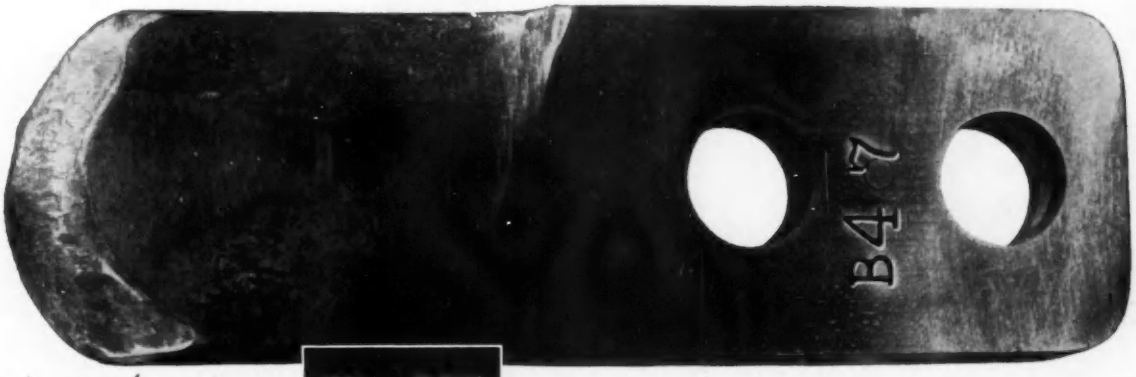
Federal® WELDERS

9967

The Federal Machine and Welder Company

WARREN, OHIO

Warco® PRESSES



This punch gave double service!

This block had double life!

This die lasted 50% longer!

B-47 HOT WORK STEEL

gives you more runs for your money

. . . anywhere from 1½ to 5 times the Performance!

SOME TYPICAL EXAMPLES

B-47 dummy blocks, vs. 9% and 12% tungsten types, extruded more than twice as many brass and copper tubes. B-47 dies outperformed 12% tungsten type 1½ to 1.

B-47 punches, vs. low-carbon 18-4-1 type, hot pierced more than twice as many eyes in steel axes. See top picture.

B-47 die inserts, vs. 9% tungsten types, hot pressed more than twice as many steel side gear forgings. B-47 die inserts, vs. regular insert material, performed better than 5 to 1.

B-47 dummy blocks, vs. 5% tungsten-5% chromium types, extruded twice as many copper and brass tubes and rods. B-47 dies outperformed 12% tungsten-12% chromium type.

B-47 punches, vs. 5% chromium type, hot extrusion forged 1½ times as many automotive steel front axle spindles.

B-47 die inserts, vs. 9% tungsten types, extruded 1½ times as many high alloy steel automotive valves. This is considered a very difficult job for any grade of hot work steel.

SEND NOW

for "Blue Sheet" on Grade B-47

This four-page folder gives technical data on B-47 for brass extrusion dummy block and dies, valve extrusion die inserts, hot punch tools, forging die inserts, press forging dies, and hot work in general. *Write for your copy today.*

ADDRESS DEPT. AI-80

Looking for a better hot work steel? You'll find it in B-47—an improved chromium, tungsten, cobalt, vanadium type whose superiority is established by actual performance runs such as those summarized above. All tests show that B-47 has unusual resistance to shock and abrasion at elevated temperatures.

Developed originally for applications in the copper and brass industry, B-47 has given excellent results on difficult hot work jobs on steel. B-47, when properly heat treated, exhibits a well rounded combination of red hardness, toughness, and resistance to wear and heat checking that makes it a valuable addition to the Allegheny Ludlum group of hot die steels.

Put B-47 to the test. You'll find that it will do any number of severe hot work jobs without washing out or changing size. Get in touch with A-L, today. Let us help you to use B-47.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

W&D 3330

AL FINE TOOL STEELS SINCE 1854

Q: *How to heat vehicles?*

Q: *Chilly day at Thule (—50°F.) . . . how to start fire-crash truck within seconds, provide 90,000 Btu/hr. in small space?*

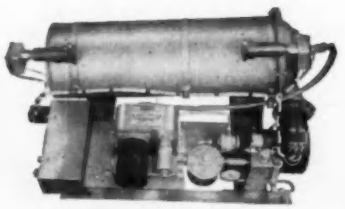
A: Janitrol liquid heater (tested to —65°F.) keeps engine ready to go, provides cab and cargo heating too!

Q: *How to find money to build heated storage buildings for Diesel bus fleet?*

A: No need to find it, park the fleet outside —Janitrol liquid heaters keep engines, and bus interiors warm, ready to go at a fraction of cost of new building.

A:

A: Call on Janitrol. If there's a need for heat for the job anywhere, chances are Janitrol can supply it, or build it from service-proved components.



Ever since designing and manufacturing the first successful heaters for aircraft 14 years ago, Janitrol has built thousands of heaters for aircraft and ground vehicles.

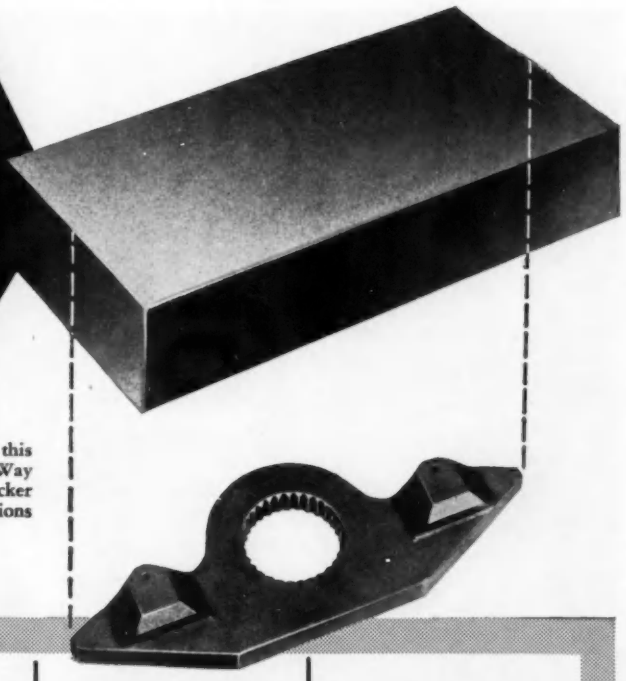
Today the name Janitrol stands for leadership in heating equipment and combustion engineering. Your Janitrol representative is always at your service.

Janitrol

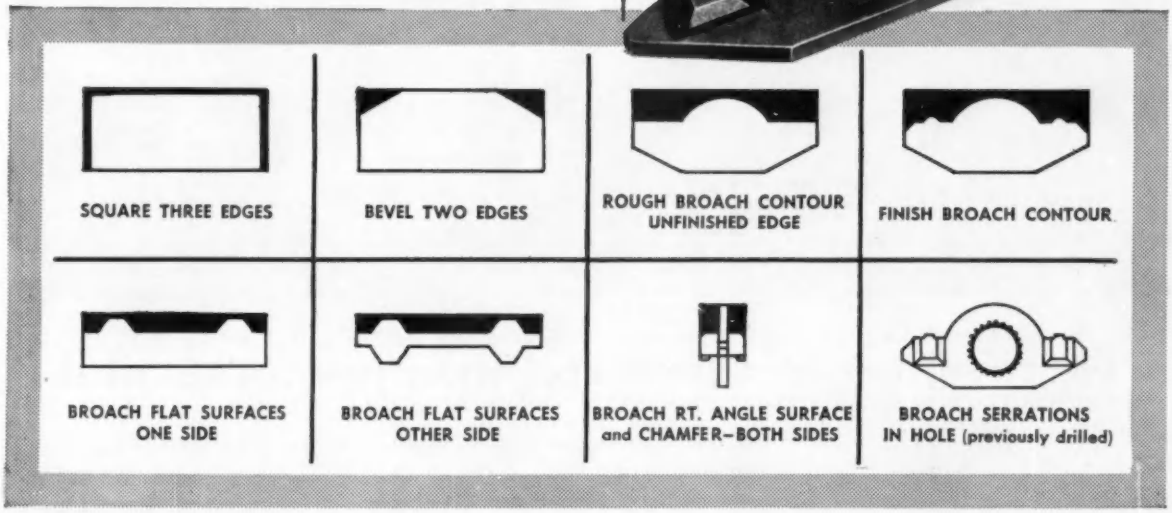
AIRCRAFT-AUTOMOTIVE DIVISION, SURFACE COMBUSTION CORPORATION, COLUMBUS 16, OHIO

DISTRICT ENGINEERING OFFICES: WASHINGTON, D.C., PHILADELPHIA, COLUMBUS, FT. WORTH, HOLLYWOOD

ROCKER ARM
machined from bar stock
in 8
BROACHING OPERATIONS



Broaching's all-round versatility is illustrated by this unusual adaptation of a standard American 3-Way broaching machine for the production of finished rocker arm part from bar stock. The eight broaching operations are shown in sequence below.


SQUARE THREE EDGES
BEVEL TWO EDGES
ROUGH BROACH CONTOUR UNFINISHED EDGE
FINISH BROACH CONTOUR
BROACH FLAT SURFACES ONE SIDE
BROACH FLAT SURFACES OTHER SIDE
BROACH RT. ANGLE SURFACE and CHAMFER–BOTH SIDES
BROACH SERRATIONS IN HOLE (previously drilled)

Small quantity production of this rocker arm part, plus a requirement that all surfaces be finished, made a forging impractical. Broaching gave the desired finish and confined the operations to one machine so that holding and locating fixtures were simplified.

American designed and built the broaches and had previously supplied the 3-Way vertical hydraulic broaching machine. But to American's good customer, The American Tool Co., Kalamazoo, Mich., goes the credit for the ingenuity displayed in developing the operation and building the interchangeable fixtures.

Whether you require eight operations on few parts, or one operation on thousands, the versatility of American broaches, fixtures and broaching machines can mean gains in your output, cuts in your costs. Give American the details; you'll receive a prompt recommendation.

ASK FOR CATALOG 450

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

There's more in this barrel than just a chemical

YOUR BIGGEST DOLLAR'S WORTH!

Excellence of product, excellence of service, and the experience, ingenuity and dedication of the organization make Parker surface treatments for metals the biggest dollar's worth in the field!

● The formulation is important in surface treatments for metals. Of equal importance, our customers tell us, are the extra services and qualities that are part of what you get with every barrel of a *Parker* surface treatment chemical.

There's over 40 years of *experience* in every Parker barrel . . . *engineering service* (without charge) to help fit the process into your plant . . . *fast availability* from plants located coast-to-coast . . . *experienced technical help* (Parker service men average over 12 years on the job) . . . continuing *research* which has pioneered developments in the field . . . *quality control, process lab* and *test facilities* which work to help customers improve their products.

For the finest metal surface treatments, plus all these advantages, call in the Parker man in your territory.

**Bonderite, Bonderlube, Parco, Parco Lubrite, Parker Pre-Namel – Reg. U.S. Pat. Off.*

PARKER RUST PROOF COMPANY
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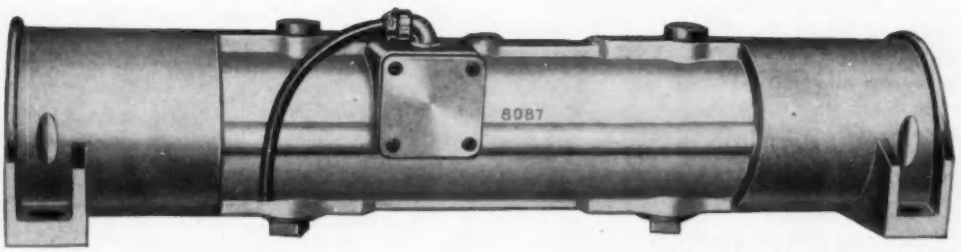
Since 1914 — leader in the field

BONDERITE	BONDERITE and BONDERLUBE	PARCO COMPOUND	PARCO LUBRITE	TROPICAL
corrosion resistant paint base	aids in cold forming of metals	rust resistant	wear resistant for friction surfaces	heavy duty maintenance paints since 1883

LIKE TEST BAR— LIKE CASTING



Shown above is the new Derrick Eccentric Motor Housing made of Frontier 40-E Aluminum Alloy.*

When the Metal is FRONTIER 40-E* Aluminum Alloy!

When you purchase Frontier 40-E Aluminum Alloy Castings from a foundry licensed to produce this alloy, you are assured of the high qualities that have made this alloy famous. All licensees are required to send test bars to the technical research laboratory of the Frontier Bronze Corporation for complete analysis and physical testing. This quality control is strictly maintained.

Frontier 40-E Aluminum Alloy is noted for its high strength. It is also a well established fact that the physical properties that spell high quality in the test bar are duplicated in the product casting. And here's another feature of Frontier 40-E. High strength is obtained by natural aging at room temperatures. Heat treating is not necessary. Frontier 40-E Aluminum Alloy is of special value for parts that must be light in weight yet strong enough to resist distortion or deformation.

Yes, like the test bar, so is the casting when the metal is Frontier 40-E Aluminum Alloy . . . see table.

FRONTIER 40-E	TEST BAR	CASTING
Yield Strength	23,500	22,700
Tensile Strength	36,600	35,500
Elongation	7.5	7.5

*REG. T. M.

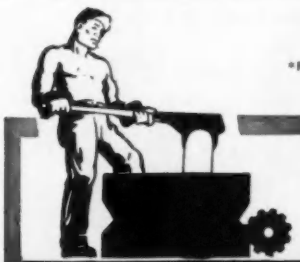
Please send me a copy of the Alloy Data Book giving Engineering and Metallurgical Facts on the physical properties of Frontier "40-E".

NAME.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....



FRONTIER BRONZE CORPORATION

4885 PACKARD ROAD, NIAGARA FALLS, NEW YORK

Imagineering the 195X models . . . in Alcoa® Aluminum

Supersonic blower made by remarkable casting process

Roaring away at 58,000 rpm, a diesel turbocharger impeller blasts a miniature tornado into the engine cylinders.

In effect the impeller blades are *airfoils*, operating in the supersonic vicinity of Mach One. To prevent turbulence and cavitation, the impeller blades must be very thin, very smooth and very delicately shaped. Needless to say, the impeller must also be very well balanced, very strong and not too expensive.

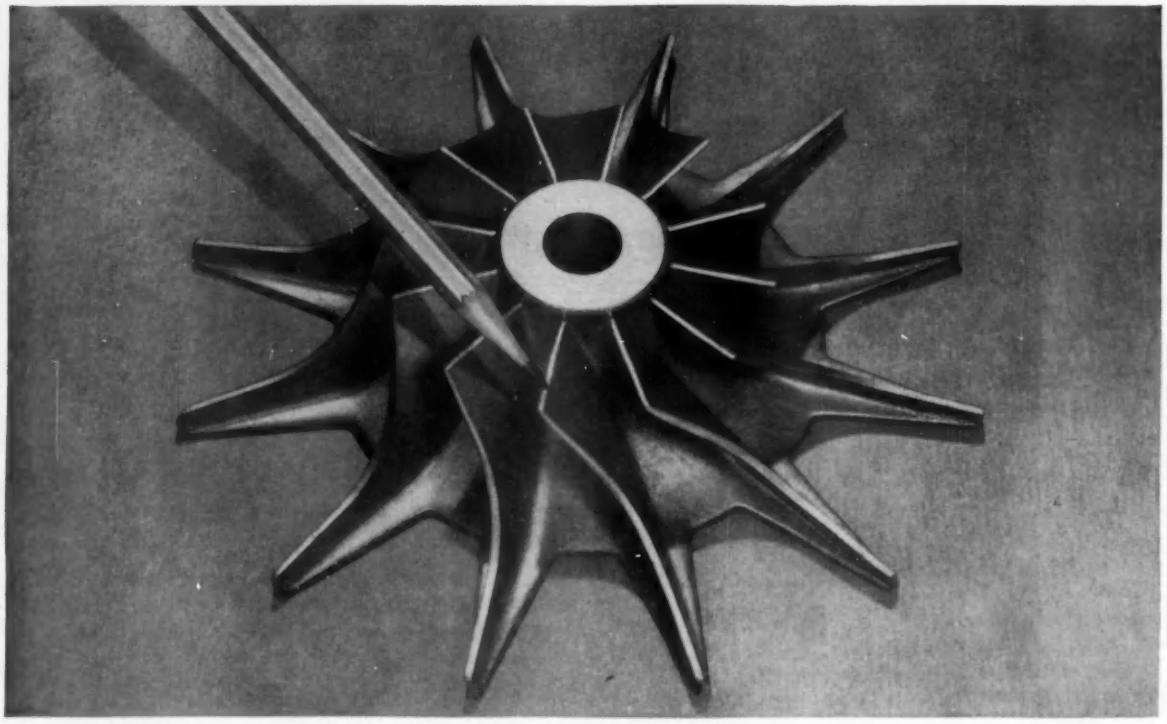
That's the problem a turbocharger manufacturer gave our Development Division. He was thinking in terms of permanent-mold castings. But we decided that our revolutionary *plaster casting* process offered the best possibilities and we set out to lick the complex technical problems.

Result: The plaster castings perfectly reproduced the delicate curved blades, with leading edges tapering to an air cleaving 0.020". (Much thinner than is possible with other casting methods.) The surface finish, at 125 microinches, keeps surface friction to a low level.

These plaster castings are accurate to 0.010" and need very little machining. This saves money and, equally important, reduces the danger of distorting or nicking the smooth blade edges.

The customer was delighted with the impeller, especially after it withstood operating tests of 70,000 rpm with no hint of failure. Nor did the cost make him unhappy.

Each year, imaginative automotive engineers make more parts better, cheaper or lighter with Alcoa Aluminum. Our Development Division has unparalleled facilities to help you imagineer *your* 195X (or '6X!) models in Alcoa Aluminum. Call us in.



For this 58,000 rpm impeller, used in the diesel turbocharger made by Schwitzer Corporation, of Indianapolis, Alcoa Development Division engineers recommended our revolutionary plaster casting process. Result: Great accuracy, fine surface finish. Let our superbly equipped Development Division help you imagineer in Alcoa Aluminum. Aluminum Company of America, 1841-H Alcoa Building, Pittsburgh 19, Pennsylvania.

Your Guide to the Best in Aluminum Value

Always Fasten Aluminum With Alcoa Aluminum Fasteners

CrysCoat*

MOVES IN THE BEST CIRCLES

CATERPILLAR-built Tractors and Scrapers have been tackling tough earth-moving jobs for fifty years. Beneath the famous yellow paint finish of these big sluggers is a fine coating of CrysCoat. It helps make the finish stand up under all kinds of heavy punishment.

There's an Oakite CrysCoat Process to suit your particular set-up :—

1. Zinc phosphating in spray washer
2. Zinc phosphating in tank
3. Iron phosphating in spray washer
4. Iron phosphating in tank

Each CrysCoat Process gives you a fine phosphate foundation for long-lasting paint adhesion.

Each CrysCoat Process protects against corrosion under the paint.

Each CrysCoat Process is easy to control.

Each CrysCoat Process is solidly backed by nationwide Oakite Service that unconditionally guarantees satisfaction.

Illustrated literature describing the Oakite CrysCoat Cleaning-Phosphating Process gladly mailed on letterhead request.
Oakite Products, Inc., 49 Rector Street, New York 6, N. Y.

**The Oakite CrysCoat Cleaning-Phosphating Process for preparing metals for painting*

SPECIALIZED INDUSTRIAL CLEANING

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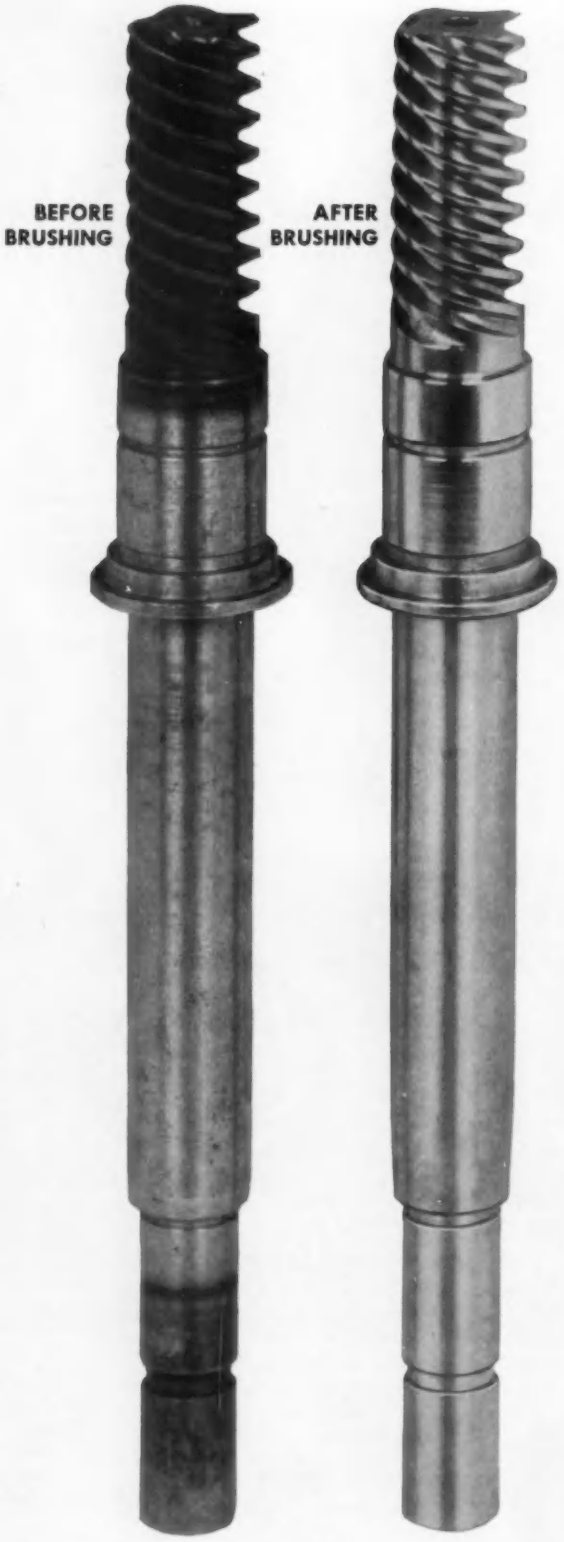
REG. U. S. PAT. OFF.

MATERIALS · METHODS · SERVICE

SCIENCE

CrysCoated Products Look Better . . . Last Longer!

Technical Service Representatives Located in Principal Cities of United States and Canada



7 finished for the price of 1

COMPLEX business machines have as many as 25,000 moving parts. Although most of these parts must meet exceptionally high quality standards, production economy is also an imperative consideration.

Take the armature shaft shown on the left, as typical. Osborn Brushamatic® methods improve the finish of the worm gear from an original 30 down to 4 micro-inches, at ⅓ the cost of the former method. *Seven parts finished for the price of one.*

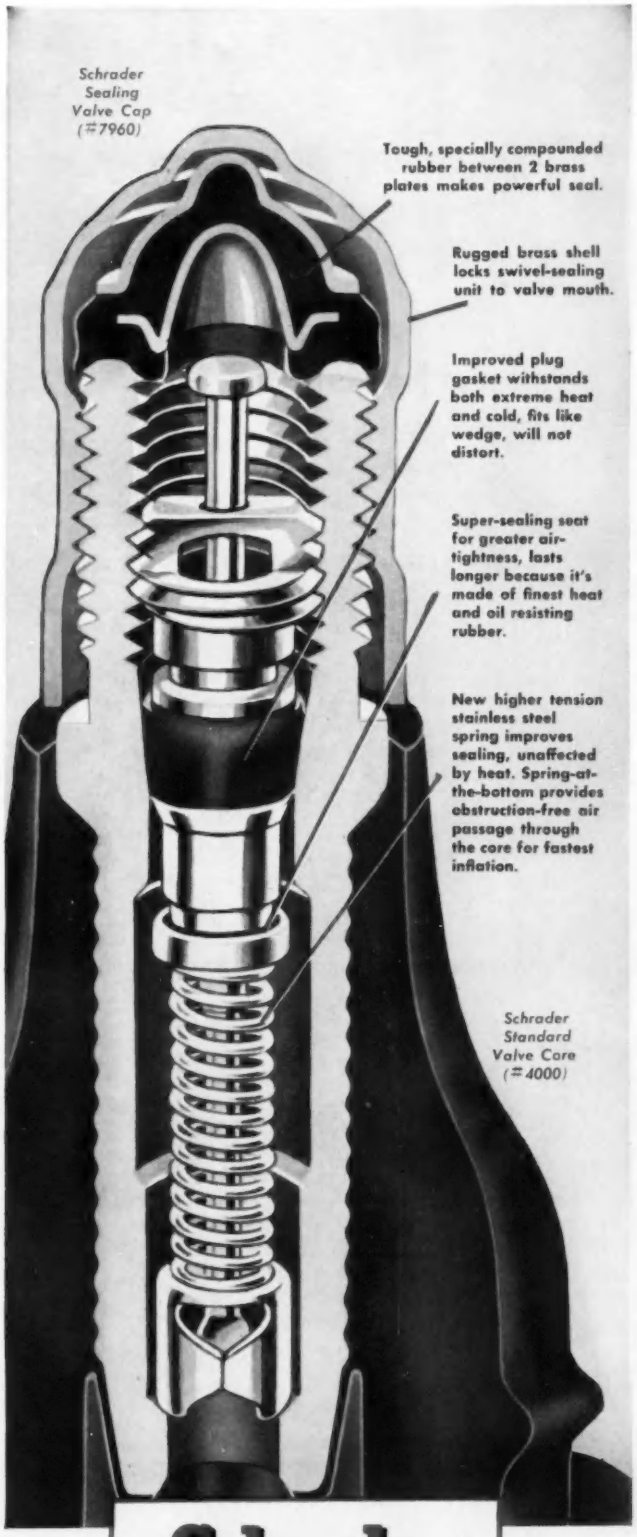
An **O**sborn **B**rushing **A**nalysis, made at no obligation to you, will point out how *you* can use Brushamatic finishing to achieve similar results and savings. Write *The Osborn Manufacturing Company, Dept. E-44, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Major manufacturer of business machines uses six different Osborn Brushamatic® 3-A machines to finish parts in lot quantities of 300 to several thousand.

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES


Schrader Sealing Valve Cap (#7960)
Tough, specially compounded rubber between 2 brass plates makes powerful seal.
Rugged brass shell locks swivel-sealing unit to valve mouth.
Improved plug gasket withstands both extreme heat and cold, fits like wedge, will not distort.
Super-sealing seat for greater air-tightness, lasts longer because it's made of finest heat and oil resisting rubber.
New higher tension stainless steel spring improves sealing, unaffected by heat. Spring-at-the-bottom provides obstruction-free air passage through the core for fastest inflation.
Schrader Standard Valve Core (#4000)

Beyond comparison...

Schrader

Quality

Schrader

Reliability

Schrader

Safety

Schrader Tire Valve Cores and Caps are respected around the world for unprecedented performance over billions of miles of travel . . . for over half a century. Precision made products, they're designed to fit every standard tire valve housing everybody has in his tires—tube or tubeless!

You use Schrader Products now to control the suspension of the vehicles. By controlling the air in the tires—you can be sure of top quality at this vital point.

Backing your product at the resale level

Service packages for all Dealer repair needs

Bulk boxes of 100 Schrader Caps or Cores

Dealer display to service their customers

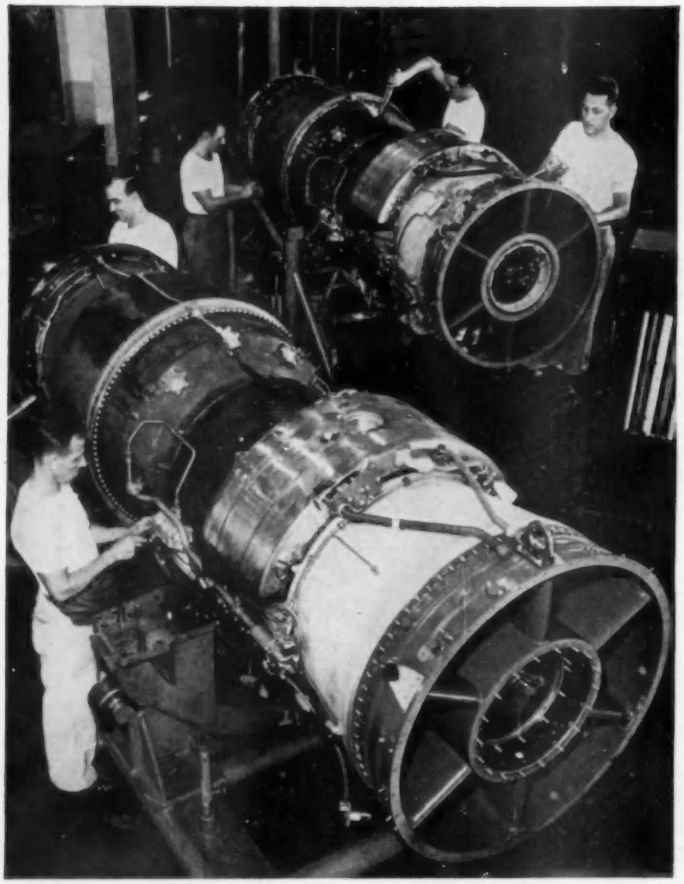
Packaged sets of five Schrader Cores or Caps

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
470 Vanderbilt Avenue, Brooklyn 38, N. Y.

Schrader®
ESTABLISHED IN 1844

FIRST NAME IN TIRE VALVES

FOR ORIGINAL EQUIPMENT AND REPLACEMENT



Pratt & Whitney's **J-57** *Turbojet: The most powerful aircraft production engine in the world is rated in the 10,000-pound thrust class.*

Why Pratt & Whitney Uses 19 Gear Grind Machines to Guarantee Performance in the World's Most Powerful Aircraft Production Engine

At Pratt & Whitney Aircraft, where finest quality gears and high production are essential to the manufacture of the J-57 Turbojet, 19 new automatic Gear Grind Machines are in daily use. Here is what Pratt & Whitney has to say:

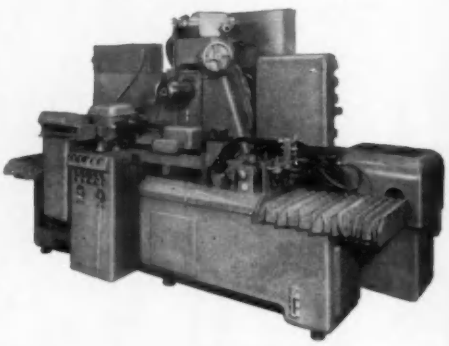
"The new Gear Grind Machines presently used in the aircraft engine division are the first major development in this type of machine since their use at Pratt & Whitney. They were developed in cooperation with Pratt & Whitney engineers to meet the specific and exacting requirements of modern aircraft engine gears. These machines are equipped with a new wheel-trimming feature and a two-speed spindle drive to eliminate burning.

"Another advantage is the relative ease with which the involute profile can be modified."

YOU'LL WANT TO KNOW MORE ABOUT THESE ADDITIONAL ADVANTAGES FOUND IN THE NEW GEAR GRIND AUTOMATICS

- Controlled flow of coolant through the grinding wheel insures non-tempered, case-hardened gears.
- Single or double diamond trimmers are used to assure a perfect blend between the tooth profile and the root fillet.
- Automatic trimming of the grinding wheel assures uniformly accurate work.
- Available as fully automatic machines incorporating automatic loading and unloading.

Write today for comprehensive eight-page brochure which explains the details.



For gears up to 36" diameter.

The Gear Grinding Machine Company

56-B

3903 Christopher, Detroit 11, Mich.

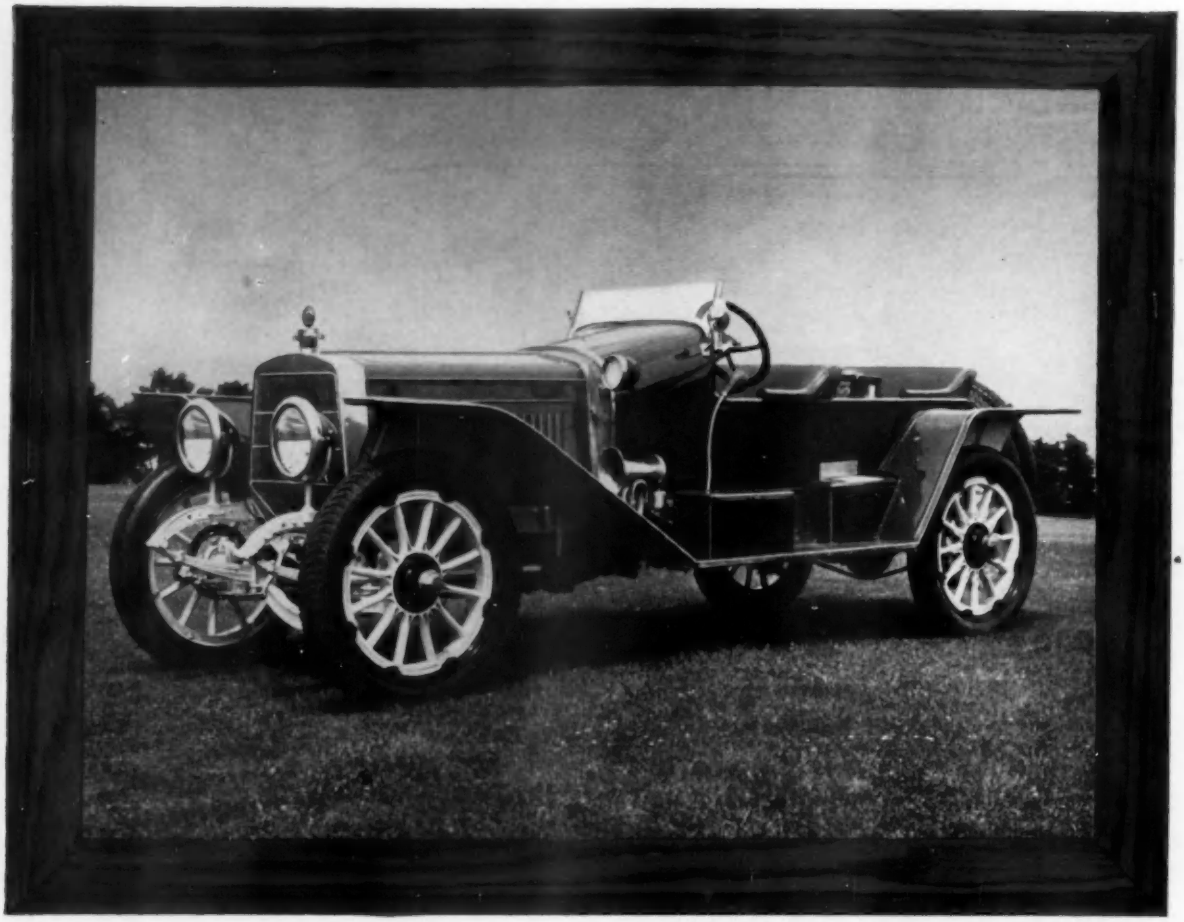
Manufacturers of:

The Detroit Screwmatic 750, Automatic Screw Machines. RZEPPA ("Sheppa") Constant Velocity Universal Joints

Now you can get from PROGRESSIVE Slotted Tapping Screws with an extra customized touch — Slotted Tapping Screws which are custom-made to your order. This means: (1) specifically made for you — not bin stock parts; (2) fast, custom-handling of every order; *plus* (3) the double economy of low initial cost *and* the savings in your assembly operations possible only with high precision, torsion-tested fasteners.

STANDARDS AND SPECIALS CUSTOMIZED FOR YOUR NEEDS

THE PROGRESSIVE MFG. CO.
Division of The Torrington Company
72 Norwood Street, Torrington, Connecticut



Send for free print—1913 Lozier. This print, from collection of P. S. DeBeaumont, not for commercial use.

"Legitimately high-priced," the 1913 Lozier cost over $5000. It featured a modified toy tonneau body, a T-head six-cylinder engine with 51 h.p. and a top speed of 81 m.p.h. Ignition was dual battery and magneto. From 1907 to 1911, the Lozier maintained an enviable racing record. This is one of a series of antique automobile prints appearing in Morse advertisements. Write for your free copy, suitable for framing, to: Morse Chain Company, Ithaca, N.Y.

Over 75,000,000 Morse Timing Chains insure long service life of cars, trucks, and buses

On nineteen of the twenty-two current makes of cars, *Morse Timing Chain Drives* are specified as original equipment. Over the years, the auto industry has used more than 75,000,000 of these durable Morse Chains. Precision-built Morse Drives give car, bus, and truck owners long service life—plus freedom from maintenance worries.

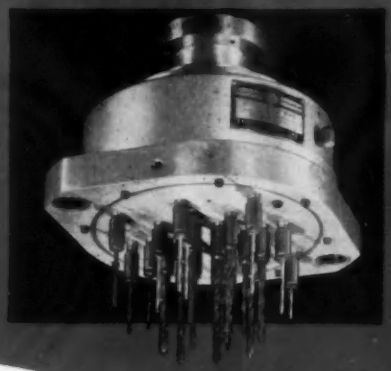
If you have problems involving timing chain in design, development or application, check first with Morse. We have expert engineering service available to help you solve them quickly, profitably.

For further information, call, wire, or write: MORSE CHAIN COMPANY, ITHACA, NEW YORK.

MORSE MORSE B&W *Trademark **POWER TRANSMISSION PRODUCTS**

MAKE ZAGAR your HOLE CENTER

FOR DRILLING, REAMING AND TAPPING . . . . . .



Any hole pattern — on any center up to 1½" dia.

Zagar's Broad-Scope Engineering SOLVES ANY HOLE PROBLEM

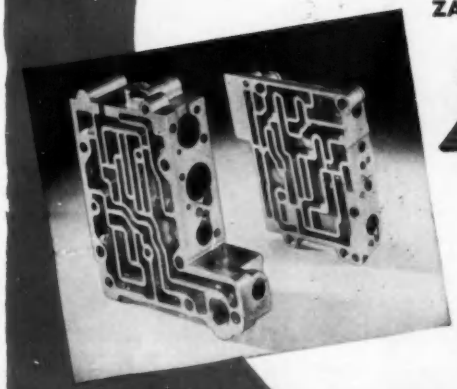
Zagar meets every drilling problem with the most effective, low cost equipment: gearless drill heads, standard drilling machines, special drilling machines, and index, trunnion or pallet-type multi-station transfer machines. We can furnish the complete tooling if you desire. Perhaps Zagar drill heads can be installed profitably on your own drill press. Send us a drawing of the part you are planning to drill. Or, let us study your present situation with a view to reducing your drilling cost.

ZAGAR, INC., 23896 Lakeland Blvd., Cleveland 23, Ohio

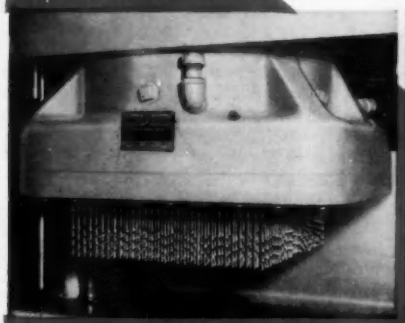
Zagar

TOOLS FOR INDUSTRY and SPECIAL MACHINERY

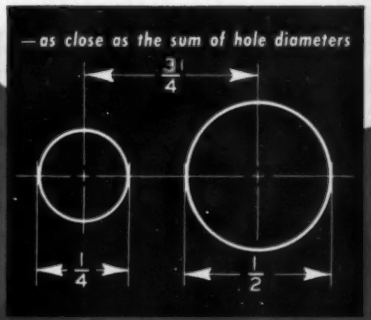
Write for our 9-page General Bulletin "U-8"

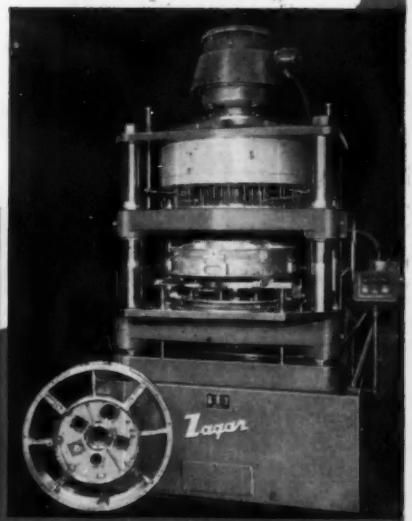


Any machinable material — from all angles.



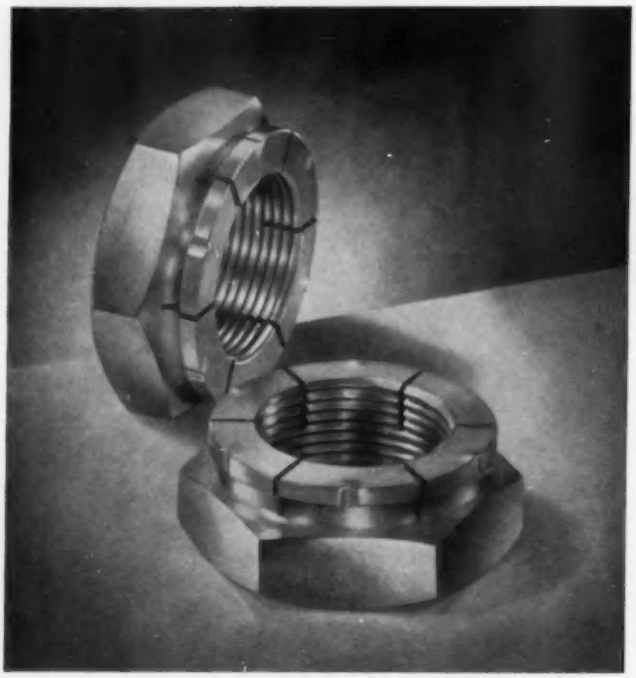
Up to 1000 holes can be drilled IN ONE PASS.



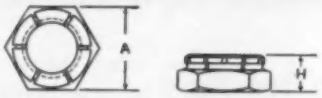


4-post ram-type drilling machine for aircraft parts.

Flexloc thin nuts save space, weight and production time



SPECIFICATIONS
FLEXLOC THIN NUTS



NATIONAL COARSE THREAD—U.S.S

SIZE	A INCHES	H INCHES	WIDTH ACROSS CORNERS	WEIGHT PER 1000 NUTS
6-32	.312	.125	.361	1.8
8-32	.344	.172	.397	2.8
10-24	.375	.172	.433	3.3
¼-20	.438	.203	.505	5.4
5/16-18	.563	.250	.649	11.6
3/8-16	.625	.265	.722	14.9
7/16-14	.750	.312	.866	24.9
½-13	.813	.312	.938	28.4
9/16-12	.875	.359	1.010	36.1
5/8-11	1.000	.391	1.155	54.1
¾-10	1.125	.406	1.299	69.2
7/8-9	1.312	.469	1.516	107.5
1-8	1.500	.563	1.732	171.6
NATIONAL FINE THREAD—S.A.E.				
6-40	.312	.125	.361	1.8
8-36	.344	.172	.397	2.8
10-32	.375	.172	.433	3.3
¼-28	.438	.203	.505	5.4
5/16-24	.500	.250	.577	8.7
3/8-24	.563	.266	.649	11.5
7/16-20	.625	.312	.722	14.9
½-20	.750	.312	.866	21.7
9/16-18	.875	.359	1.010	36.2
5/8-18	.938	.391	1.082	42.4
¾-16	1.063	.406	1.227	54.5
7/8-14	1.250	.469	1.443	84.6
1-14	1.438	.563	1.660	136.3
1 1/16-12*	1.625	.625	1.876	193.5
1 ¼-12*	1.813	.750	2.093	296.0
1 3/16-12*	2.000	.812	2.309	389.0
1 ½-12*	2.187	.875	2.526	498.0

*Steel only (plain or cadmium plated) in stock sizes.

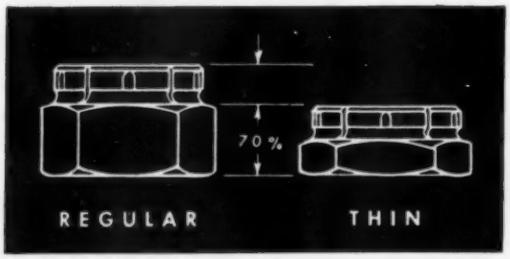
Self-locking nuts are 30% lower and lighter; speed up assembly with hand or power tools

Self-locking FLEXLOC thin nuts are 30% lower than regular height locknuts of the same nominal diameter. They fit into spaces where regular height locknuts will not go. You can design lighter, more compact units with them.

Where you must reduce weight in a completed assembly, you can save by using shorter bolts with these lighter nuts. And you save production time. The length of engagement of mating threads is shorter: fewer revolutions of hand wrenches or power nut runners are needed to seat them.

FLEXLOC nuts are of 1-piece, all-metal construction. You can use a FLEXLOC fully seated as a locknut or at any point along a bolt as a stop nut. Once the threads in the resilient locking section are fully engaged, the FLEXLOC grips the mating threads with uniform locking torque wherever wrenching stops. Since there are no nonmetallic inserts to come out or deteriorate, the locking life of a FLEXLOC is virtually unlimited.

Your authorized industrial distributor stocks FLEXLOC nuts in a variety of sizes, materials and finishes. Consult him for details. Or write us for information about your special locknut problem. Flexloc Locknut Division, STANDARD PRESSED STEEL Co., Jenkintown 53, Pa.



FLEXLOC thin nuts are 30% lower than regular height locknuts. There is a corresponding saving in weight. In sizes through 5/16 in., thin FLEXLOCs meet tensile strength requirements for regular height locknuts. FLEXLOC nuts can be made in the thin type because every thread, even those in the locking section, carries its full share of the load. There are no nonmetallic inserts to waste head space or weaken the structure of the nut.

Standard FLEXLOC self-locking thin nuts are available in plain or cadmium plated alloy steel, for use in temperatures to 550°F; in plain or silver plated corrosion resisting steel, for temperatures to 750°F; and in brass and aluminum, for temperatures to 250°F.

STANDARD PRESSED STEEL CO.
FLEXLOC LOCKNUT DIVISION SPS
JENKINTOWN PENNSYLVANIA

Adjustable to either concave or convex shape, Heller flexible VIXEN® files are particularly adapted to any type of work where an accurate curved surface must be achieved. The deep gullets and wide pitch designed into the milled curved-teeth of VIXEN files prevent clogging or loading . . . even on soft metals and fibrous materials. The special undercut of the VIXEN's teeth takes a deep bite . . . and leaves a smooth, scratch-free surface. Available in the rigid tang, as well as the flexible type. No other milled curved-tooth file equals the original VIXEN.

IDENTIFY VIXEN FLEXIBLE BY THE WHITE ENVELOPE . . . VIXEN RIGID BY THE WHITE TANG

Try These Other Famous HELLER BRAND FILES:

HELLER® American-Swiss SWISS PATTERN

NUCUT® AMERICAN PATTERN

HELLER TOOL CO.

Subsidiary of Simonds Saw and Steel Co.

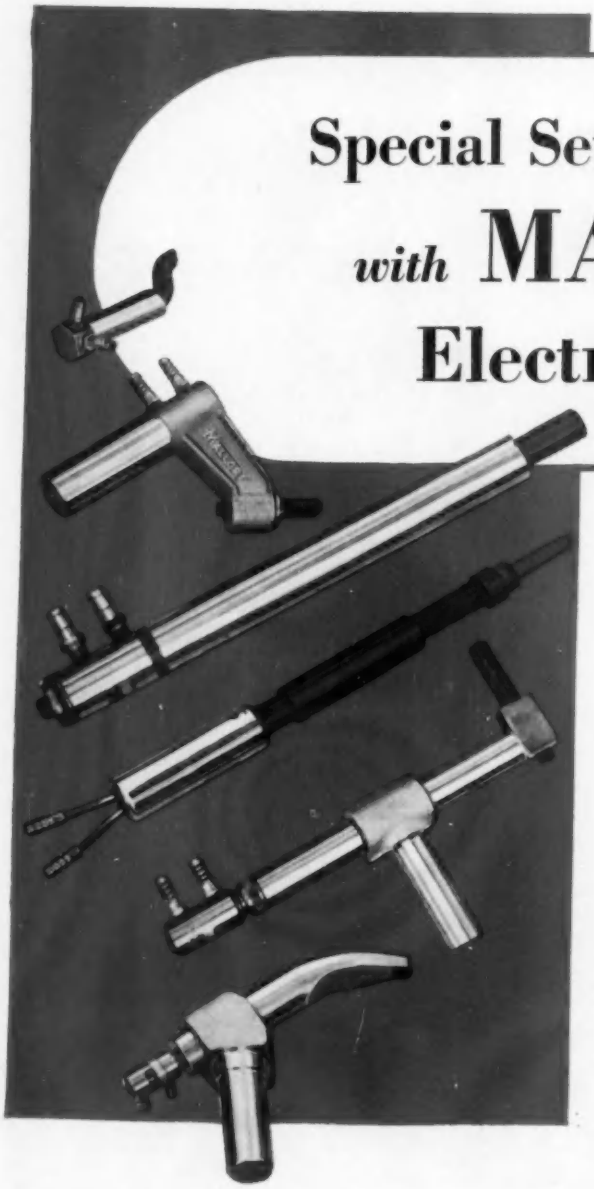
NEWCOMERSTOWN, OHIO

Branches: New York, Detroit, Chicago, Los Angeles

HELLER TOOL CO. SINCE 1836

YOUR HELLER DISTRIBUTOR CAN SUPPLY *ALL* YOUR FILE NEEDS

Special Set-Ups Made Easy...
with MALLORY Electrode Holders



BEFORE you go to the time and expense of getting a custom-made holder for a welding job, take a look at the variety of standard Mallory Electrode Holders. You can probably pick out the design your application requires ... at substantial savings in cost and delivery.

The most complete line in the industry, Mallory Electrode Holders offer many varied designs ... straight, offset, paddle type, swivel head, low inertia, universal and close-coupled. Light, standard and heavy-duty models are available for pressure ranges from under 100 lbs. to more than 6000 lbs.

By using these versatile holders in combination with the hundreds of different types of Mallory welding electrodes, you can assemble an almost unlimited variety of welding set-ups. Most welds in channels, or other hard-to-reach locations can be made with standard Mallory welding parts. And when your application poses problems outside of the range of standard models, Mallory engineers are well qualified to design special holders and electrodes for your individual needs.

Look through the Mallory Resistance Welding Catalog and pick out a series of holders that will equip your shop for the range of work you are doing. Your nearby Mallory distributor will be glad to give you a copy of this useful catalog and to help in your selection ... or you can get one by writing direct to Mallory.

Expect more...
Get more from

P.R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry Street, Toronto 15, Ontario

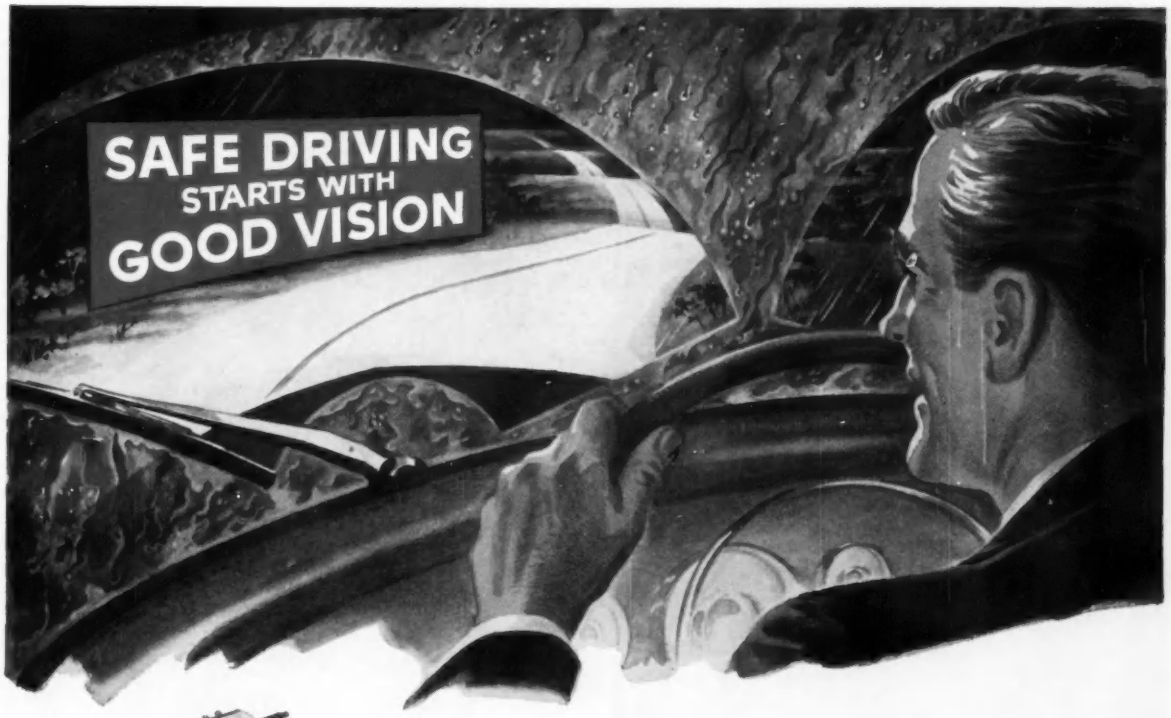
STOCK ELECTRODES

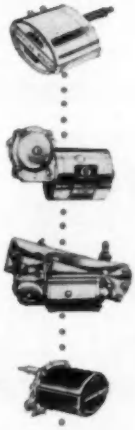
Hundreds of shapes and sizes are available in stock ... with round water holes or the exclusive Mallory fluted cooling hole for longer life between dressings. Save you both in cost and delivery time.

STANDARD ELECTRODES

Odd-shaped electrodes you consider "specials" may well be standard items for Mallory ... can be made quickly with existing tools, in a wide range of single-bend, double-bend and irregular shapes.

For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio





DUAL & SINGLE TYPES
For Automotive and Marine Applications for 6-12-24 v. Systems

Design for Safety with
AMERICAN BOSCH
Constant ELECTRIC *Action*
WINDSHIELD WIPERS

Car and Truck drivers travel more accident-free miles, even in the toughest weather, when they have constantly clear vision with American Bosch *Electric* Windshield Wipers. Regardless of speed or load, on up-grades and during acceleration, American Bosch *Constant Electric Action* is steady and dependable. Independent of engine vacuum, it eliminates stuttering, stalling blades—helps keep drivers in the clear and out of trouble on the road.

American Bosch *Electric* Wipers are in wide use as original equipment. There are Dual and Single types, models for large size arms and blades—dependable Windshield Wipers with heavy duty construction that guarantees years of trouble-free service.

These famous *Electric* Windshield Wipers are today's positive answer to good vision in bad weather, and they offer a keen, sales-active feature for your vehicles. Ask for complete specifications. American Bosch, Springfield 7, Mass. A Division of American Bosch Arma Corporation.

AMERICAN BOSCH

Quantity
PRODUCTION
of
GREY IRON CASTINGS

ONE OF THE NATION'S
LARGEST AND MOST MODERN
PRODUCTION FOUNDRIES

ESTABLISHED 1866
THE WHELAND COMPANY
FOUNDRY DIVISION

MAIN OFFICE AND MANUFACTURING PLANTS
CHATTANOOGA 2, TENNESSEE

MILFORD

TUBULAR RIVETS
SPLIT RIVETS
COLD-FORMED SPECIALTIES
RIVET-SETTING MACHINES

MILFORD RIVET

THE
MILFORD
RIVET & MACHINE CO.

PLANTS: MILFORD, CONNECTICUT
HATBORO, PENNSYLVANIA • ELYRIA, OHIO
AURORA, ILLINOIS • NORWALK, CALIFORNIA

SPEED SENSITIVE SWITCHES

MODEL GHM

Synchro-Start units are available in two body designs for one, two and three switches. The GS series is for a standard distributor take-off with gear or coupling drive and has oilless bronze bushings. The GH body is for standard SAE tachometer drive and runs in oil sealed ball bearings.

These units contain snap action switches rated at 10 Amps.-110 Volts A.C. and can be used for either opening or closing a circuit at any RPM over 500. Adjustable while the engine is running for a plus or minus 20% of set speed.

The model shown here was designed for overspeed shutdown and is made for either automatic or manual re-set. Dust caps can be furnished with a variety of standard or special connector fittings.

SYNCHRO-START PRODUCTS, INC.
Automatic Engine Control Equipment
8151 NORTH RIDGEWAY AVENUE, SKOKIE, ILLINOIS

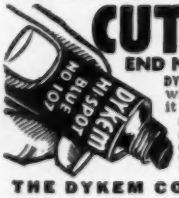
DYKEM
STEEL BLUE
Stops Losses
making Dies and Templates

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301L North 11th St. • St. Louis 6, Mo.

CUT SCRAPER TIME
END NIGHT CLEANUP & MORNING REBLUING



DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

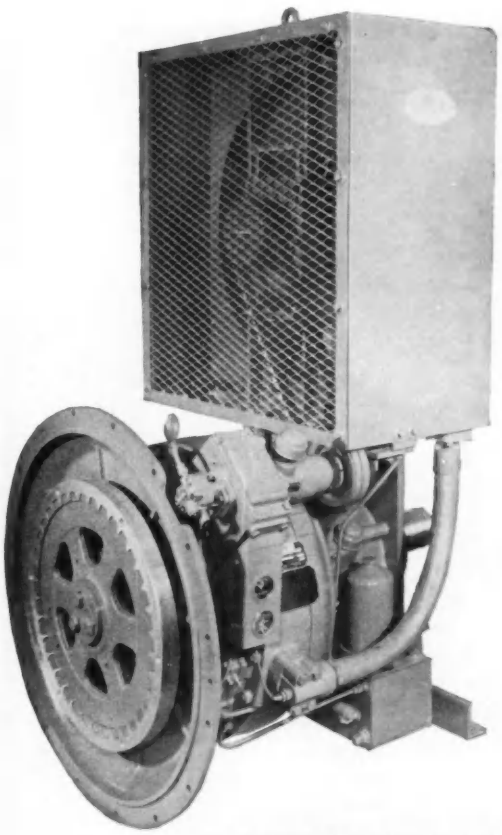
THE DYKEM CO., 2301L NORTH 11TH ST., ST. LOUIS 6, MO.

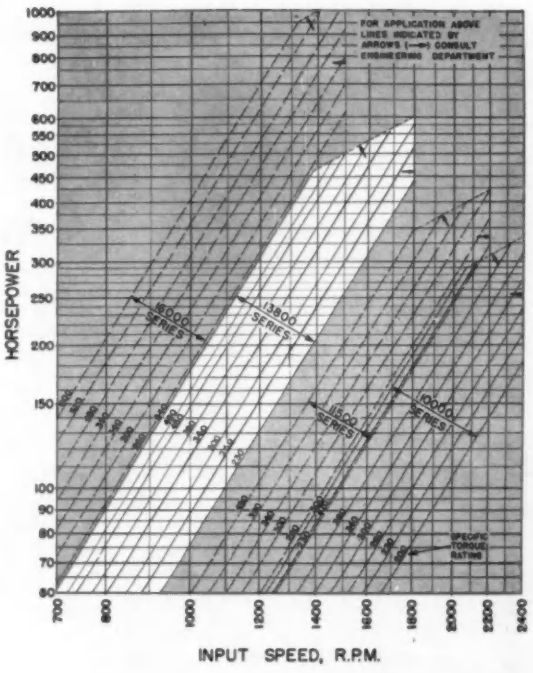
TRACK SUPPLIES
RAILS

New RAILS *Relaying*
TRACKWORK of ALL KINDS
LIGHT RAILS—12# TO 60#—20'0" & 30'0"
HEAVY RAILS—60# TO 100#—30'0" & 33'0"
JOINT BARS, BOLTS, TIE PLATES, SPIKES & TOOLS, FROGS, SWITCHES, STANDARD & SPECIAL TRACKWORK.

ALSO IN STOCK STEEL SHEETS & PLATES STRUCTURALS and Aluminum Products

SEND US YOUR INQUIRIES
KASLE STEEL CORPORATION
BOX 536 ROOSEVELT PARK ANNEX, DETROIT 32, MICH.—PHONE TIFFANY 6-4300





ENGINE APPLICATIONS

Mfr.—Model	Mfr.—Model	Mfr.—Model
Allis-Chalmers 6DC2505	Climax R-165	Mercedes-Benz MB636 Bb
Allis-Chalmers 6PC1879	Cummins LR-6	Murphy 112
Allis-Chalmers 6DC51879	Cummins NVHS-12	Murphy 120
Allis-Chalmers 6DC1879	Cummins VT-12	Murphy 121
Allis-Chalmers 8PC2505	Deutz BA6M517	Murphy 122
Caterpillar D342	Fairbanks 38T1/4-4	Murphy 124
Caterpillar D353	Gardner 6-L3	Murphy 224
Caterpillar D3750-BA	Hall-Scott V-12	Murphy 322
Caterpillar D3750-BB	Hercules DXHS-8TS	Murphy 324
Climax R-61	Lelio F-1500	Sterling V-36
Climax R-62	Lelio R-2000	Waukesha M498
Climax R-75	M.A.N. S8V175/122 A	Waukesha M498
Climax V-80	M.A.N. S8V175/122 A	Waukesha M808S
Climax V-85	Mercedes-Benz MB836 B	Waukesha L498

ANNOUNCING . . . *the new Twin Disc 13,800 Series Three-Stage Torque Converter*

By W. B. Gibson, Sales Manager

Hydraulic Division, Twin Disc Clutch Company, Rockford, Illinois

With announcement of the new 13,800 Series, the Twin Disc Clutch Company *now* provides a three-stage torque converter for every horsepower range from 40 to 1,000—offering four distinct sizes, with a total of twenty-nine capacities, through internal blading variations.

Designed specifically to accommodate a large number of engines for which previous models were not ideally suited (see listing above)—this new series is planned around a *simple basic unit*—with easy-to-add components which produce ten specific models. This arrangement permits extreme flexibility and speedy interchange of components to provide a model specifically adapted to a wide variety of applications.

The 13,800 Series provides two *output* arrangements. There is *one standard output shaft assembly* designed for maximum side pull loads up to the full capacity of the converter. On this particular output shaft assembly, an output governor take-off is available. There is also *one standard output flange* designed for universal joint or flexible gear coupling drive.

There are also three *input* arrangements—spider drive, incorporating a rubber block drive — which withstands normal misalignment conditions without imposing undue loads or stresses on the input shaft or the engine crankshaft; clutch assembly and independent mounting. In addition to being offered in ten different models, this new torque converter can be adapted, with appropriate engine speeds, to all engines in the 60 to 600 horsepower range by internal blading variations.

Get all the facts on the advantages of torque converter drive in equipment that *you're* planning or designing. Write *now,* to the Hydraulic Division, Rockford, Illinois.

Twin Disc Clutch Company
Racine, Wisconsin
Hydraulic Division, Rockford, Illinois

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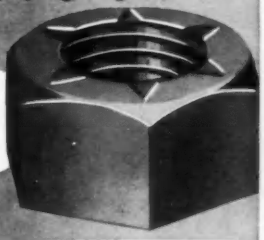
use a GRIPCO LOCK NUT

- To Hold Tighter
- To Last Longer
- To Cost Less



in these and hundreds of other applications where stress, wear or vibration is a factor. The Gripco Lock Nut, with its simple, one-piece design, has given industry a tighter, more positive holding action for quicker fastener application at less initial cost. No inserts, outside devices or complicated features – the Gripco Lock Nut holding or locking action is inherent in the nut itself – it costs less to use, gives an easier, faster locking and holds tighter for a longer time. Impervious to oil or water. For faster production, lower manufacturing and maintenance costs, look into the Gripco Lock Nut today.

GRIPCO PRODUCTS INCLUDE: Gripco Lock Nuts, New Gripco "Clinch" Nuts, Gripco Hi-Nuts, Gripco Pilot-Projection and Countersunk Weld Nuts with or without Gripco locking feature.

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NEW

NEW

NEW

ESPECIALLY DESIGNED FOR TOP RING GROOVE PROTECTION IN PISTONS FOR GASOLINE ENGINES

AN ECONOMICAL METHOD WITH MINIMUM WEIGHT INCREASE

CAN BE APPLIED TO ANY TYPE ALUMINUM ALLOY PISTON

PERMA-GROOVE*

WITH SEGMENTAL STEEL TOP RING SECTION

TOP RING SECTION

FRONT VIEW SECTION

CROSS SECTION

Again, Zollner engineering leadership provides another great piston development to engine builders. The new Zollner "Perma-Groove" gives sensationally longer life to pistons and rings, prevents blow-by, minimizes oil consumption. The light weight segmental steel section incorporates high wear resistance in the top ring groove *plus* the advantage of cool operation. Designed especially for gasoline engine pistons, "Perma-Groove" is the quality, low-weight and low-cost companion to the popular "Bond-O-Loc" piston for Diesel engines. We suggest an immediate test of "Perma-Groove" advantages for your gasoline engine.

*T. M. Reg. Pat. App. For

OUTSTANDING ADVANTAGES OF ZOLLNER "PERMA-GROOVE" TOP RING SECTION

1. Individual steel segments eliminate continuous band expansion problem.
2. Segments securely locked to prevent radial movement.
3. Dovetailed edges keep steel segments securely in plane with groove.
4. 75% steel bearing area for wear resistance.
5. 25% aluminum bearing area for heat conductivity and cool operation.
6. Light in weight.

ADVANCED ENGINEERING

PRECISION PRODUCTION

COOPERATION WITH ENGINE BUILDERS

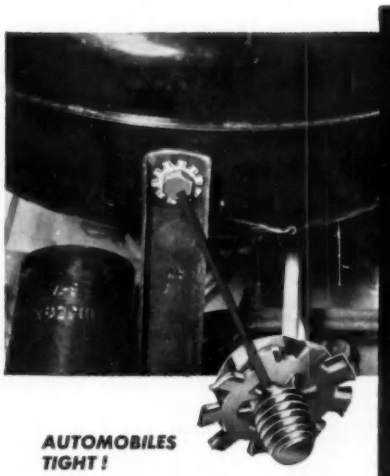
ZOLLNER PISTONS

THE ORIGINAL EQUIPMENT PISTONS

ZOLLNER

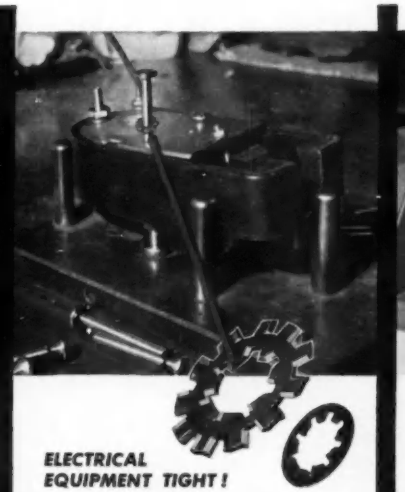
ZOLLNER CORPORATION • Fort Wayne, Indiana

Everlock lock fasteners



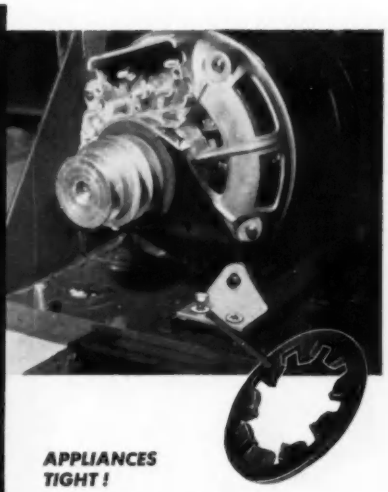
AUTOMOBILES TIGHT!

Fast-handling Everlock Sems with combination internal-external lock washers proved the perfect answer for this intake air filter fastening . . . one of many automotive applications.



ELECTRICAL EQUIPMENT TIGHT!

Everlock external and internal lock washers enable this temperature control to laugh at vibration. Any product that must be tight to be right needs Everlock.

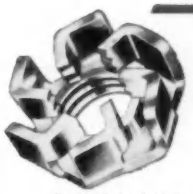


APPLIANCES TIGHT!

This motor will never loosen thanks to Everlock internal lock washer's 2-way bite. Vibration actually makes these amazing fasteners grip tighter.

2-way bite locks assemblies tight

Everlock Sems



Everlock Lock Nuts

Everlock Lock Washers

Everlock Terminals

Another AMF Product
Everlock
INDUSTRIAL FASTENERS

Nothing else holds like an Everlock lock fastener. Each angled tooth has two chisel edges, one bites deep into the work the other into the screw. And Everlock's teeth are *precision set*. The *entire edge surface* — not just the point — bites in, top and bottom, to give an unbreakable hold. Vibration, constant jarring and impact actually *tighten* Everlock's bulldog bite.

For the best in fast-handling Sems, lock washers, lock nuts and terminals, *your* specs should say Everlock. Fast delivery on all sizes, types and finishes.

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FACTS

about

NEW DEPARTURE
BALL BEARINGS

Split Inner Ring Main Shaft Ball Bearing

FOR AIRCRAFT TURBINES

High speeds, high temperatures and heavy loads . . . both radial and thrust . . . characterize bearing applications for turbines used in present ultra-fast aircraft.

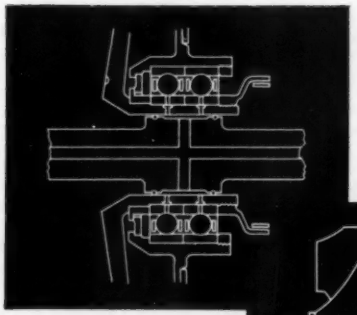
New Departure's Aircraft Bearing Research Program has produced ball bearings for highly satisfactory operation in small, medium and large turbines and their accessories.

Under this program, ball bearings of different steels dimensionally stabilized for high-temperature operation have been developed and produced. Needs for bearings with high-thrust capacity and varied lubricating methods have been met. And, bearings with various geometrical specialities to satisfy difficult mounting and operational requirements were designed.

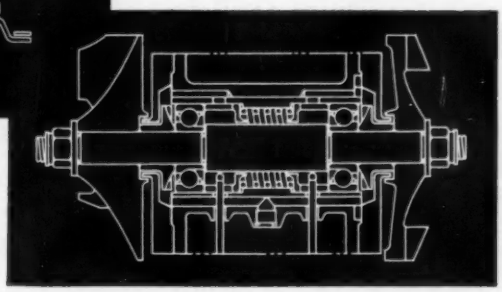
Beyond this, New Departure is working on bearing developments for the more powerful, faster aircraft of tomorrow.

For further details, send for Folder TB, on turbine bearings.

Accessory Ball Bearings



LEFT: Split Inner Ring Bearings on Turbine Main Shaft



RIGHT: Typical Installation of Ball Bearings in a Refrigeration Turbine

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